

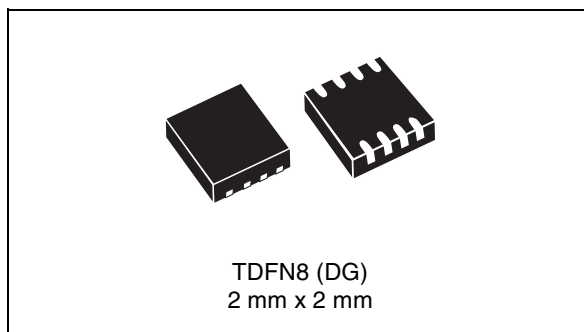


# STM6502, STM6503 STM6504, STM6505

## Dual push-button Smart Reset™ with user-adjustable setup delays

### Features

- Dual Smart Reset push-button inputs with extended reset setup delay
- Adjustable Smart Reset setup delay ( $t_{SRC}$ ): by external capacitor or three-state logic (product options):  $t_{SRC} = 2, 6, 10$  s (min.)
- Power-on reset
- Single  $\overline{RST}$  output, active-low, open-drain
- Factory-programmable thresholds to monitor  $V_{CC}$  in the range of 1.575 to 4.625 V typ.
- Operating voltage 1.0 V (active-low output valid) to 5.5 V
- Low supply current
- Operating temperature: industrial grade  $-40$  °C to  $+85$  °C
- TDFN8 package: 2 mm x 2 mm x 0.75 mm
- RoHS compliant



### Applications

- Mobile phones, smartphones
- e-books
- MP3 players
- Games
- Portable navigation devices
- Any application that requires delayed reset push-button(s) response for improved system stability

Table 1. Device summary

| Part number            | Voltage inputs |           | Smart Reset inputs |                  |                            | $t_{SRC}$ programming |                       | Reset or Power Good outputs |                  | Package |
|------------------------|----------------|-----------|--------------------|------------------|----------------------------|-----------------------|-----------------------|-----------------------------|------------------|---------|
|                        | $V_{CC}$       | $V_{BAT}$ | $\overline{SR0}$   | $\overline{SR1}$ | SRE immediate, independent | Ext. SRC pin          | Three-state input TSR | $\overline{RST}$            | $\overline{BLD}$ |         |
| STM6502 <sup>(1)</sup> | ✓              |           | ✓                  | ✓                |                            | ✓                     |                       | ✓                           |                  | TDFN-8L |
| STM6503                | ✓              |           | ✓                  | ✓                |                            |                       | ✓                     | ✓                           |                  | TDFN-8L |
| STM6504 <sup>(1)</sup> | ✓              |           | ✓                  |                  | ✓                          |                       | ✓                     | ✓                           |                  | TDFN-8L |
| STM6505                | ✓              | ✓         | ✓                  | ✓                |                            | ✓                     |                       | ✓                           | ✓                | TDFN-8L |

1. Contact local ST sales office for availability.

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# 1 Description

**STM6502** has two combined Smart Reset inputs ( $\overline{\text{SR0}}$  and  $\overline{\text{SR1}}$ ) with delayed Smart Reset setup time ( $t_{\text{SRC}}$ ) programmed by an external capacitor on the SRC pin.

**STM6503** is similar to STM6502, has two combined delayed Smart Reset inputs ( $\overline{\text{SR0}}$ ,  $\overline{\text{SR1}}$ ) and three user-selectable delayed Smart Reset setup time ( $t_{\text{SRC}}$ ) options of 2 s, 6 s and 10 s through a three-state TSR input pin: when connected to ground,  $t_{\text{SRC}} = 2$  s; when left open,  $t_{\text{SRC}} = 6$  s; when connected to  $V_{\text{CC}}$ ,  $t_{\text{SRC}} = 10$  s (all the times are minimum).

**STM6504** has two independent Smart Reset inputs.  $\overline{\text{SR0}}$  provides the delayed Smart Reset setup time ( $t_{\text{SRC}}$ ) function with three user-selectable  $t_{\text{SRC}}$  options through a three-state TSR input pin: when connected to ground,  $t_{\text{SRC}} = 2$  s; when left open,  $t_{\text{SRC}} = 6$  s; when connected to  $V_{\text{CC}}$ ,  $t_{\text{SRC}} = 10$  s (all the times are minimum). SRE provides instant reset. SRE is edge-triggered with a special debounce time ( $t_{\text{DEBOUNCE}} = 240$  ms min.) at the falling edge after a valid reset period.

**STM6505** has two combined delayed Smart Reset inputs ( $\overline{\text{SR0}}$ ,  $\overline{\text{SR1}}$ ) and provides an adjustable reset delay setup time via an external capacitor connected to the SRC pin. The  $\overline{\text{RST}}$  output depends also on the  $V_{\text{CC}}$  monitoring threshold. STM6505 also provides independent low battery detect ( $\overline{\text{BLD}}$ ) output controlled by the secondary external input voltage  $V_{\text{BAT}}$ .  $V_{\text{BAT}}$  is monitored for low voltage and provides an indication on the battery low detect output pin ( $\overline{\text{BLD}}$ ).  $V_{\text{BAT}}$  threshold is 1.25 V, fixed, and an external resistor divider is to be used to set the actual battery voltage threshold.  $V_{\text{BAT}}$  threshold hysteresis is 8 mV typ. (16 mV max.).  $V_{\text{BAT}}$  is voltage monitoring input only, the device is powered only from the  $V_{\text{CC}}$  pin;  $V_{\text{CC}}$  must be  $\geq 1.575$  V for proper operation of the  $V_{\text{BAT}}$  comparator.

## 1.1 Smart Reset devices

The Smart Reset device family STM65xx provides a useful feature that ensures inadvertent short reset push-button closures do not cause system resets. This is done by implementing extended Smart Reset input delay ( $t_{\text{SRC}}$ ). Once the valid Smart Reset input levels and setup delay are met, the device generates an output reset pulse with user-programmable timeout period ( $t_{\text{REC}}$ ).

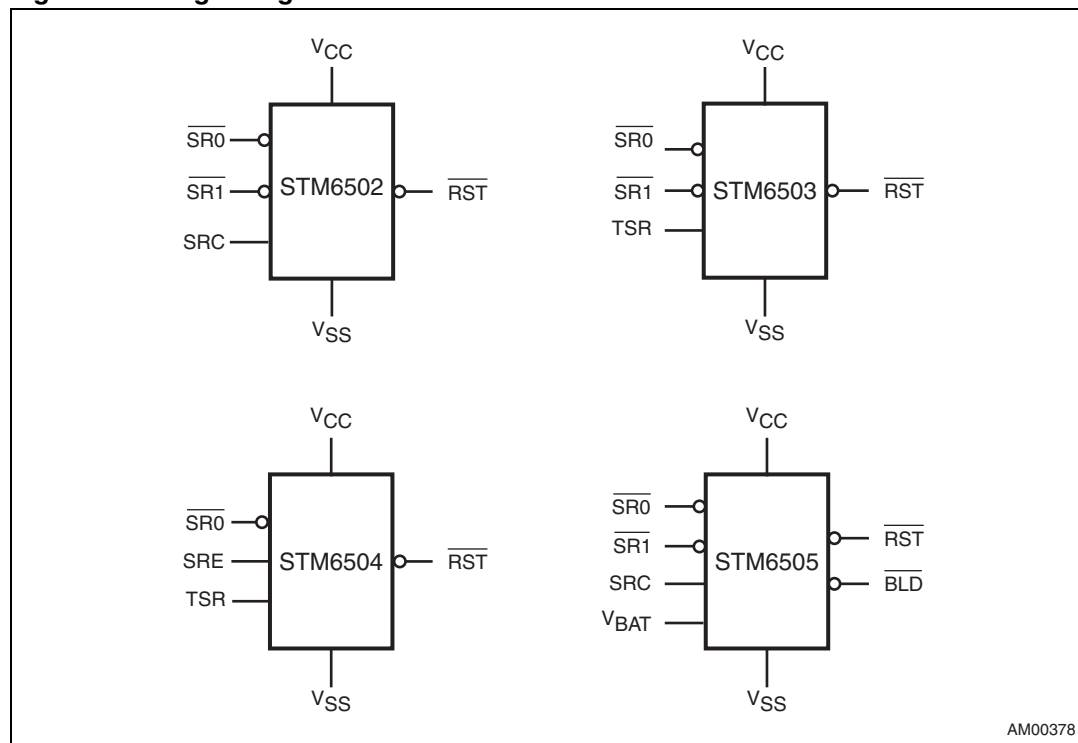
The Smart Reset inputs can be also connected to the applications interrupt to allow the control of both the interrupt pin and the hard reset functions. If the push-buttons are closed for a short time, the processor is only interrupted. If the system still does not respond properly, holding the push-buttons for the extended setup time ( $t_{\text{SRC}}$ ) causes hard reset of the processor through the reset outputs. The Smart Reset feature helps significantly increase system stability.

The STM65xx family of Smart Reset devices consists of low current microprocessor reset circuits targeted at applications such as MP3 players, navigation, smartphones or mobile phones; generally any application that requires delayed reset push-button(s) response for improved system stability. The STM65xx devices feature single or dual Smart Reset inputs (SR). The delayed Smart Reset setup time ( $t_{\text{SRC}}$ ) options of 2 s, 6 s and 10 s (all min.) are adjustable by an external capacitor on the SRC pin or selectable by three-state logic. The delayed setup period ignores switch closures shorter than  $t_{\text{SRC}}$ , thus preventing unwanted resets.

The STM65xx devices have active-low (optionally active-high) open-drain reset ( $\overline{\text{RST}}$ ) output(s) with or without internal pull-up resistor or push-pull as output options, with factory-programmed or capacitor-adjustable or push-buttons defined output reset pulse duration, with or without power-on reset function.

Some devices also have an undervoltage monitoring feature: the reset output is also asserted when the monitored supply voltage  $V_{CC}$  drops below the specified threshold. The reset output remains asserted for the reset timeout period ( $t_{\text{REC}}$ ) after the monitored supply voltage goes above the specified threshold.

**Figure 1. Logic diagrams**



**Figure 2. Pin connections**

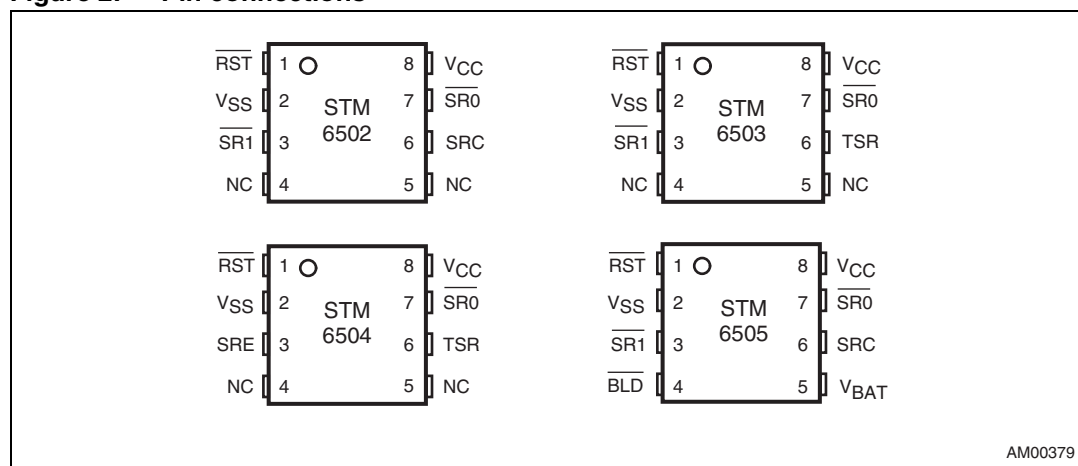
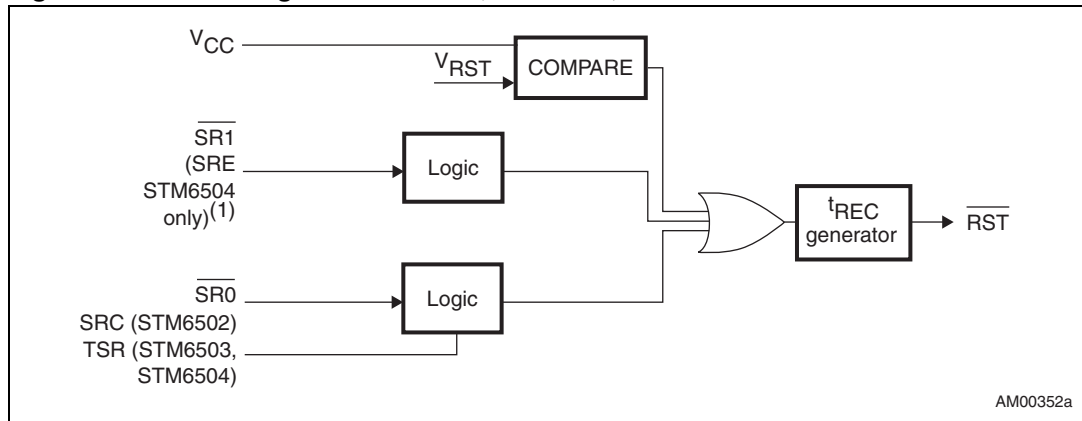


Table 2. Signal names

| Symbol                  | Input/output | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $\overline{\text{RST}}$ | Output       | Open-drain reset output, active-low.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| $\overline{\text{BLD}}$ | Output       | Battery low detect output, active-low, open-drain. STM6505 only.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| $\overline{\text{SR0}}$ | Input        | Primary push-button Smart Reset input. Active-low, with or without internal 65 k $\Omega$ pull-up to $V_{\text{CC}}$ (product options).                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| $\overline{\text{SR1}}$ | Input        | Secondary push-button Smart Reset input - combines with the primary push-button reset to provide setup delay time before reset. Active-low, with or without internal 65 k $\Omega$ pull-up to $V_{\text{CC}}$ (product options).                                                                                                                                                                                                                                                                                                                                                                                  |
| SRE                     | Input        | Secondary push-button Smart Reset input - provides instant Smart Reset. SRE is edge-triggered with a special debounce time ( $t_{\text{DEBOUNCE}} = 240 \text{ ms min.}$ ) at the falling edge after a valid reset period. Active-high, no internal pull-up to $V_{\text{CC}}$ . STM6504 only.                                                                                                                                                                                                                                                                                                                    |
| SRC                     | Input        | Smart Reset input delay setup control: connect to an external capacitor to adjust the delay setup time ( $t_{\text{SRC}}$ ). STM6502 and STM6505 only.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| TSR                     | Input        | A three-state Smart Reset input delay setup control. When connected to ground, $t_{\text{SRC}} = 2 \text{ s}$ ; when left open, $t_{\text{SRC}} = 6 \text{ s}$ ; when connected to $V_{\text{CC}}$ , $t_{\text{SRC}} = 10 \text{ s}$ (all times are minimum). TSR is a DC-type input, intended to be either permanently grounded, permanently connected to $V_{\text{CC}}$ or permanently left open. If left open, for improved system glitch immunity it is strongly recommended to connect a 0.1 $\mu\text{F}$ decoupling ceramic capacitor between the TSR and $V_{\text{SS}}$ pins. STM6503 and STM6504 only. |
| $V_{\text{CC}}$         | Supply       | Supply voltage input. Power supply for the device and an input for the monitored supply voltage. A 0.1 $\mu\text{F}$ decoupling ceramic capacitor is recommended to be connected between the $V_{\text{CC}}$ and $V_{\text{SS}}$ pins.                                                                                                                                                                                                                                                                                                                                                                            |
| $V_{\text{BAT}}$        | Input        | Battery voltage monitoring input. STM6505 only.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| $V_{\text{SS}}$         | Supply       | Ground                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| NC                      |              | No connect (not bonded); should be connected to $V_{\text{SS}}$ .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

**Figure 3. Block diagram - STM6502, STM6503, STM6504**

1. STM6504 only:  $\overline{SR0}$  and SRE are working independently. SRE is edge-triggered and has a special debounce time ( $t_{DEBOUNCE} = 240 \text{ ms min.}$ ) at the falling edge after a valid reset period.

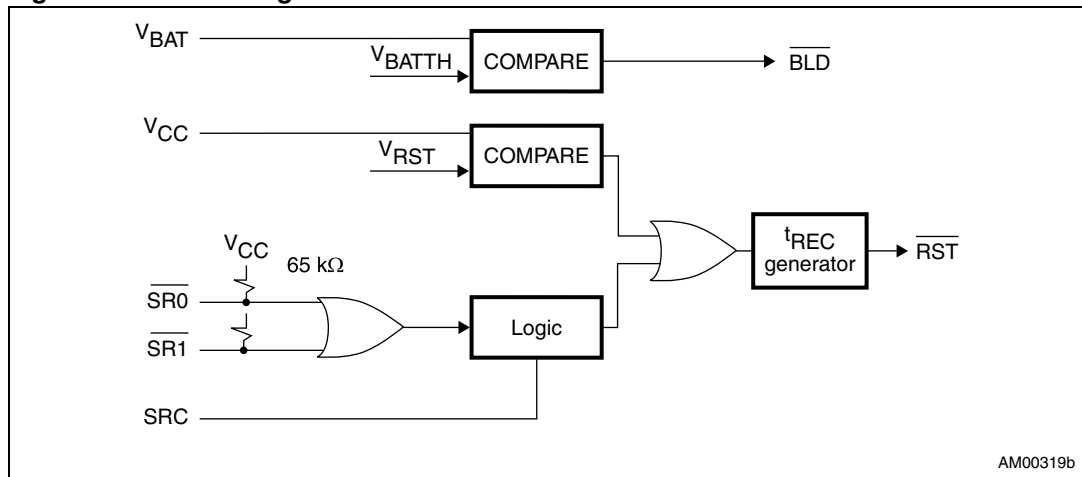
**Figure 4. Block diagram - STM6505**

Figure 5. Single-button Smart Reset typical hookup

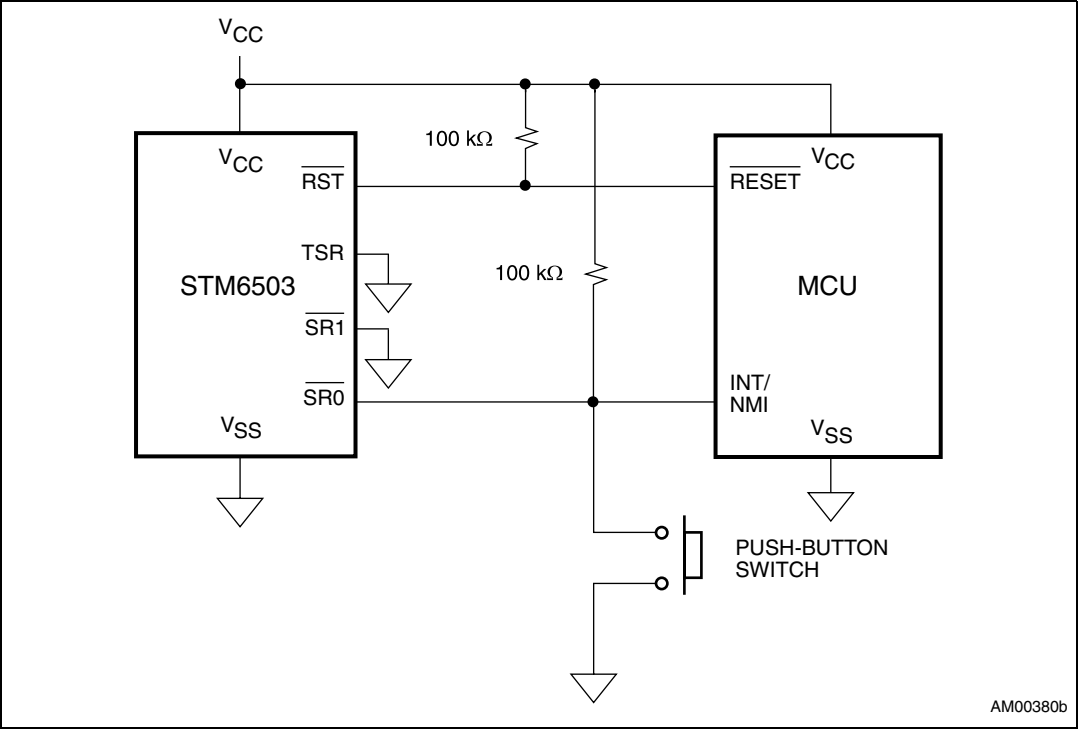
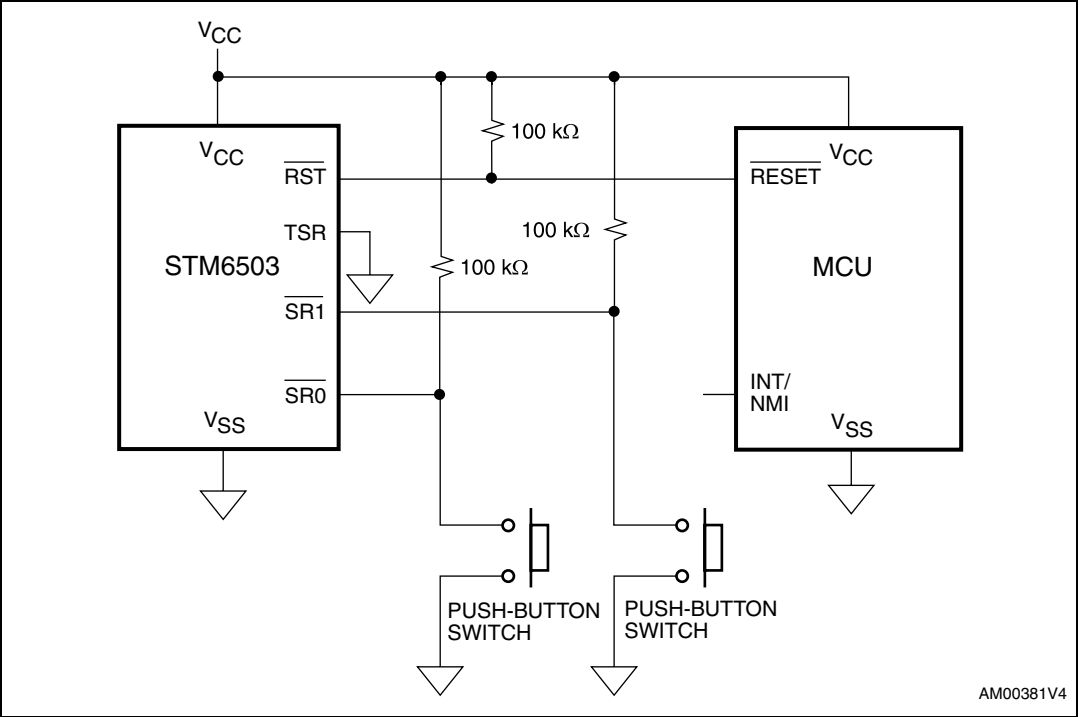


Figure 6. Dual-button Smart Reset typical hookup



## 1.2 Pin descriptions

### 1.2.1 Power supply ( $V_{CC}$ )

This pin is used to provide the power to the device and to monitor the power supply. A 0.1  $\mu$ F decoupling ceramic capacitor is recommended to be connected between the  $V_{CC}$  and  $V_{SS}$  pins.

### 1.2.2 Ground ( $V_{SS}$ )

This is the supply ground for the device.

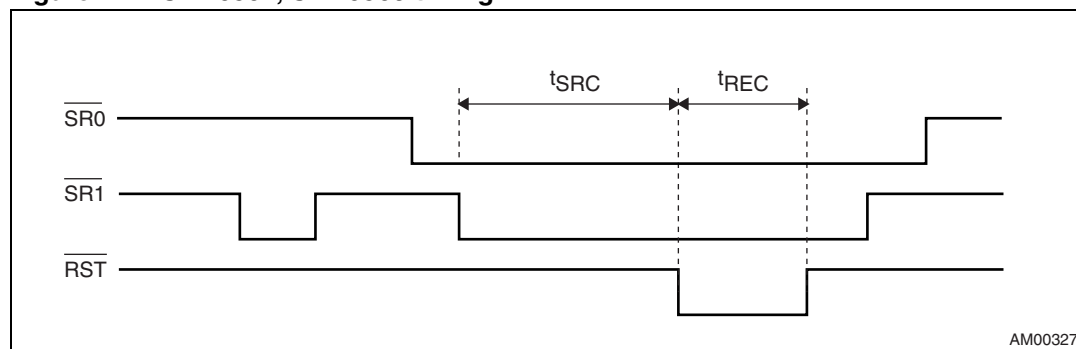
### 1.2.3 Primary Smart Reset input ( $\overline{SR0}$ )

The primary push-button Smart Reset input, active-low pin is connected to the first push-button switch.

### 1.2.4 Secondary Smart Reset input ( $\overline{SR1}$ )

The secondary push-button Smart Reset input, active-low pin is connected to the second push-button switch. Keeping both Smart Reset inputs  $\overline{SR0}$  and  $\overline{SR1}$  active for longer than  $t_{SRC}$  activates the reset output pulse.

**Figure 7. STM6502, STM6503 timing**



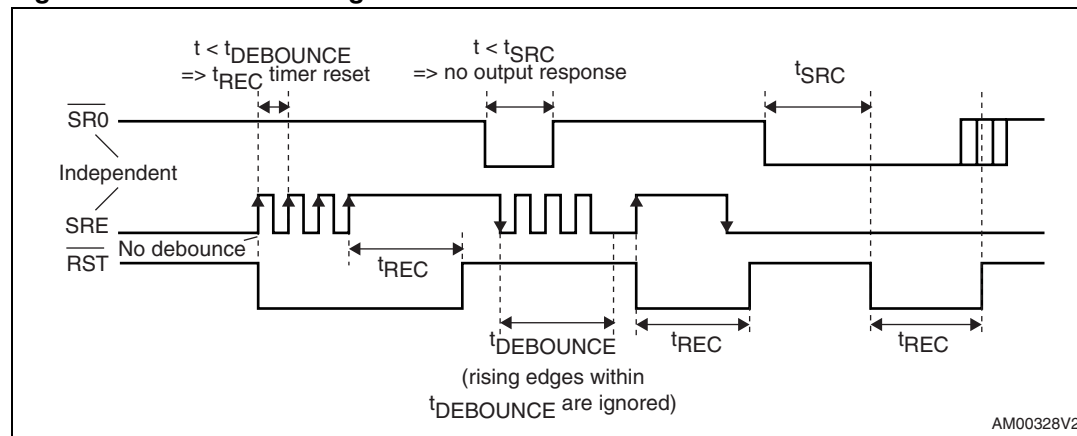
Reset is asserted “low” right after the Smart Reset setup delay ( $t_{SRC}$ ) has been met and returns to high after the  $t_{REC}$  period.

### 1.2.5 Edge-triggered Smart Reset input (SRE pin) – STM6504 only

The SRE pin is active-high, immediate and independent reset input that includes an edge trigger with debounce delay  $t_{\text{DEBOUNCE}}$  on the falling edge.

*Note:* The triggering edge must be a high-to-low or low-to-high transition with a slew-rate faster than 1 V/ $\mu$ s typ.

**Figure 8. STM6504 timing**



### 1.2.6 Adjustable delay of Smart Reset input (SRC pin) – STM6502 and STM6505 only

This pin controls the setup time before the push-button action is validated by the reset output. It is connected to an external capacitor ( $C_{\text{SRC}}$ ), which is tied to ground to provide the desired value of the setup time ( $t_{\text{SRC}}$ ).

Calculated  $t_{\text{SRC}}$  and  $C_{\text{SRC}}$  examples are given in [Table 3](#). Refer also to [Table 6](#).

**Table 3.  $t_{\text{SRC}}$  programmed by an ideal external capacitor – STM6502 and STM6505**

| Calculated $C_{\text{SRC}}$ value [ $\mu$ F] | Setup delay $t_{\text{SRC}}$ [s] <sup>(1)(2)</sup> |      |      | Closest common $C_{\text{SRC}}$ value [ $\mu$ F] |
|----------------------------------------------|----------------------------------------------------|------|------|--------------------------------------------------|
|                                              | Min.                                               | Typ. | Max. |                                                  |
| 0.2                                          | 2                                                  | 2.5  | 3.0  | 0.22                                             |
| 0.3                                          | 3                                                  | 3.75 | 4.5  | 0.33                                             |
| 0.6                                          | 6                                                  | 7.5  | 9    | 0.56                                             |
| 1                                            | 10                                                 | 12.5 | 15   | 1                                                |

- At 25 °C. Example calculations based on an ideal capacitor. During application design and component selection it should be considered that the current flowing into the external  $t_{\text{SRC}}$  programming capacitor ( $C_{\text{SRC}}$ ) is on the order of 100 nA, therefore a low-leakage capacitor (ceramic or film capacitor) should be used and placed as close as possible to the SRC pin. Also an adequate low-leakage PCB environment should be ensured to prevent  $t_{\text{SRC}}$  accuracy from being affected. A recommended minimum value of  $C_{\text{SRC}}$  is 0.01  $\mu$ F.
- In case of repeated activations of the  $t_{\text{SRC}}$  timer, an interval of 10 ms min. is needed between the activations to fully discharge  $C_{\text{SRC}}$ , so that the next  $t_{\text{SRC}}$  is as specified.

### 1.2.7 Programmable Smart Reset input delay (TSR pin) – STM6503 and STM6504 only

The TSR pin allows the user to program the setup time before the push-button action is validated by the reset output. It is controlled by different voltage levels on the three-state TSR input pin: when connected to ground,  $t_{SRC} = 2$  s; when left open,  $t_{SRC} = 6$  s; when connected to  $V_{CC}$ ,  $t_{SRC} = 10$  s (all times are minimum). TSR is a DC-type input, intended to be either permanently grounded, permanently connected to  $V_{CC}$  or permanently left open. If it is left open, for improved system glitch immunity it is strongly recommended to connect a 0.1  $\mu$ F decoupling ceramic capacitor between the TSR and  $V_{SS}$  pins.

### 1.2.8 Reset output ( $\overline{RST}$ )

$\overline{RST}$  is the active-low, open-drain reset output in the Smart Reset family.

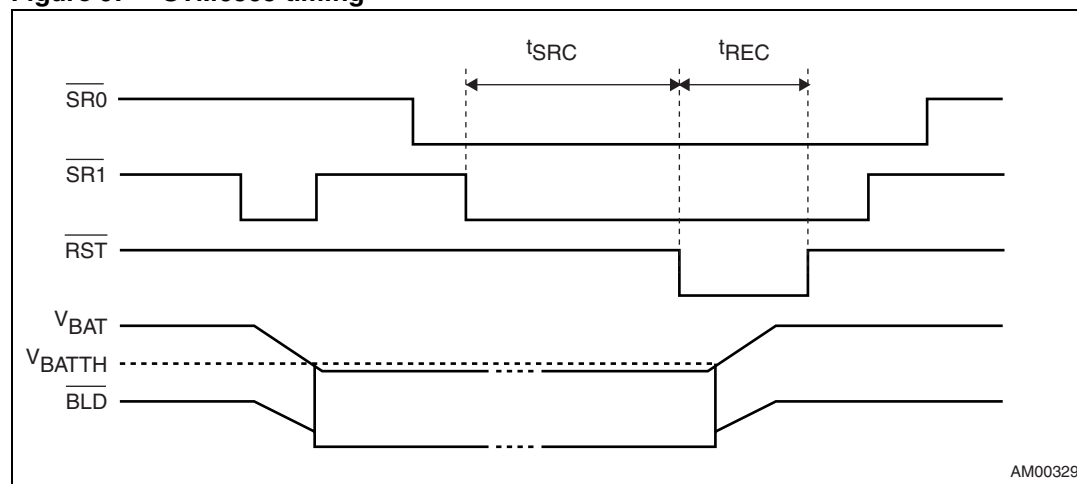
### 1.2.9 Battery monitoring input ( $V_{BAT}$ ) – STM6505 only

$V_{BAT}$  is an input for monitoring the battery voltage.  $V_{BAT}$  threshold is 1.25 V, fixed, and an external resistor divider is to be used to set the actual battery voltage threshold.

### 1.2.10 Battery low detect output ( $\overline{BLD}$ ) – STM6505 only

The battery low detect output is controlled by the  $V_{BAT}$  voltage monitoring input and is active-low, open-drain, with no pull-up.

**Figure 9. STM6505 timing**



## 2 Typical operating characteristics

Figure 10. Supply current ( $I_{CC}$ ) vs. temperature (STM6505)

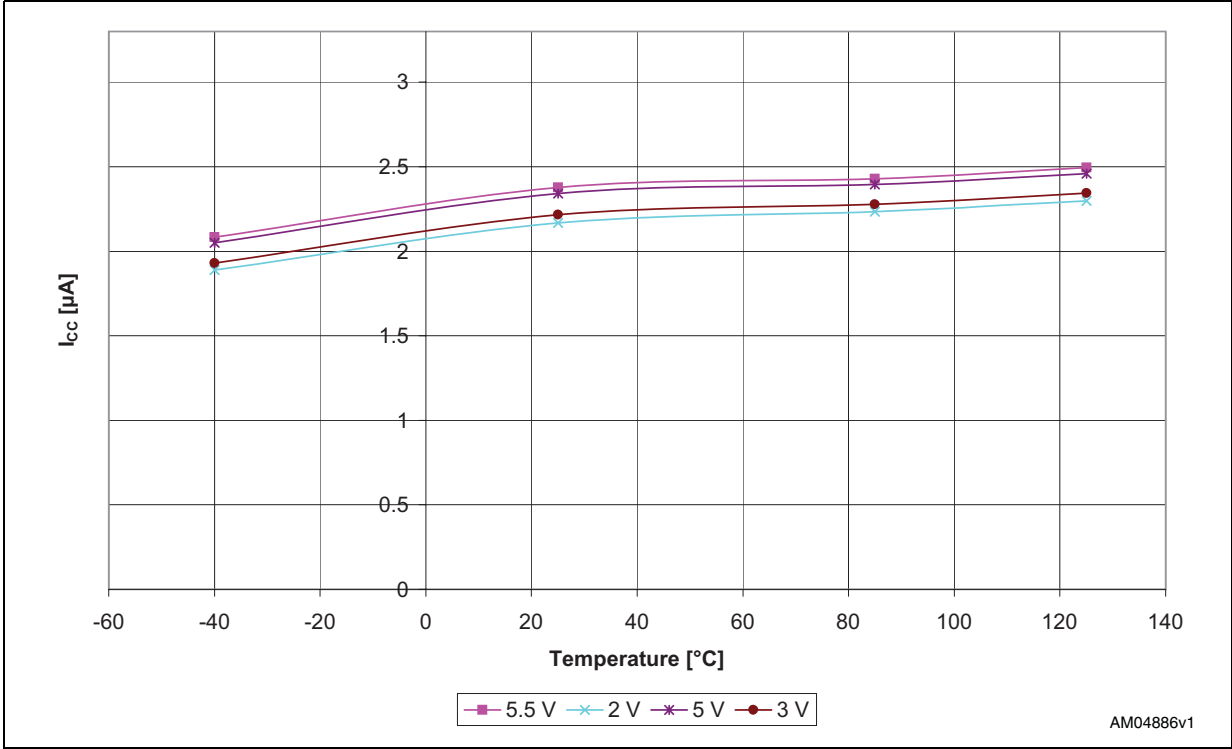


Figure 11. Smart Reset delay ( $t_{SRC}$ ) vs. temperature,  $C_{SRC} = 0.62 \mu F$  (STM6505)

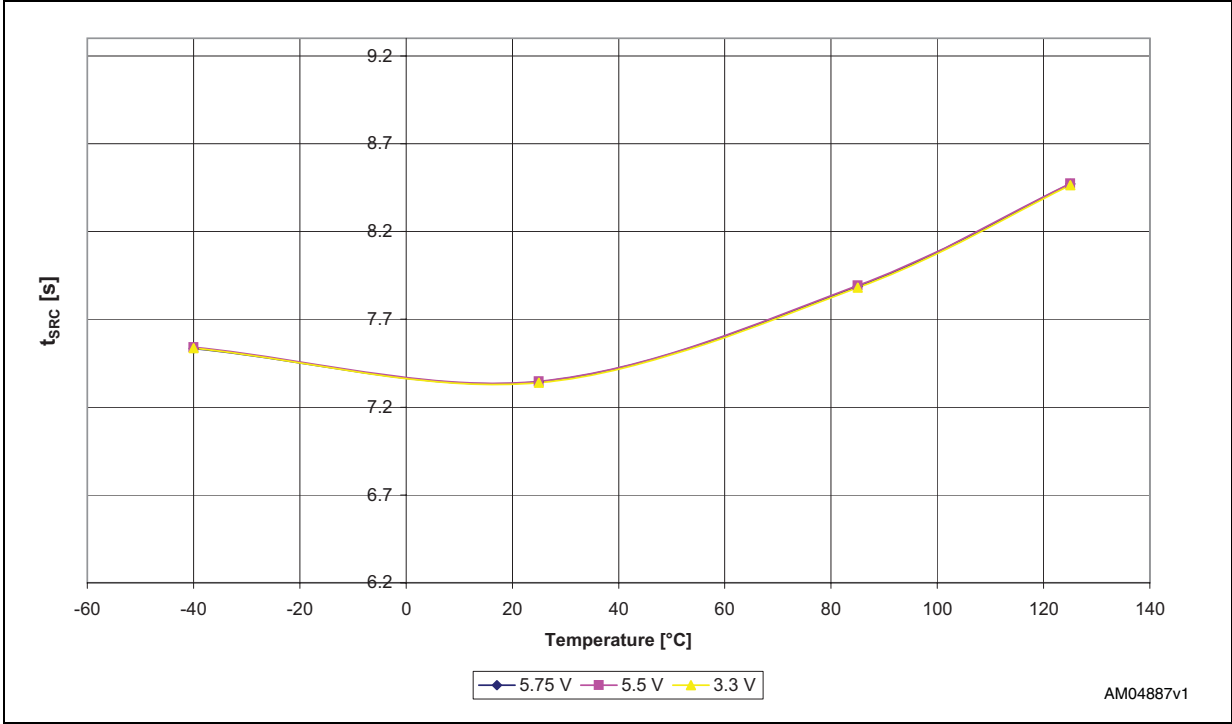


Figure 12. Reset threshold ( $V_{RST}$ ) vs. temperature, “S” threshold option,  $V_{CC}$  falling (STM6505)

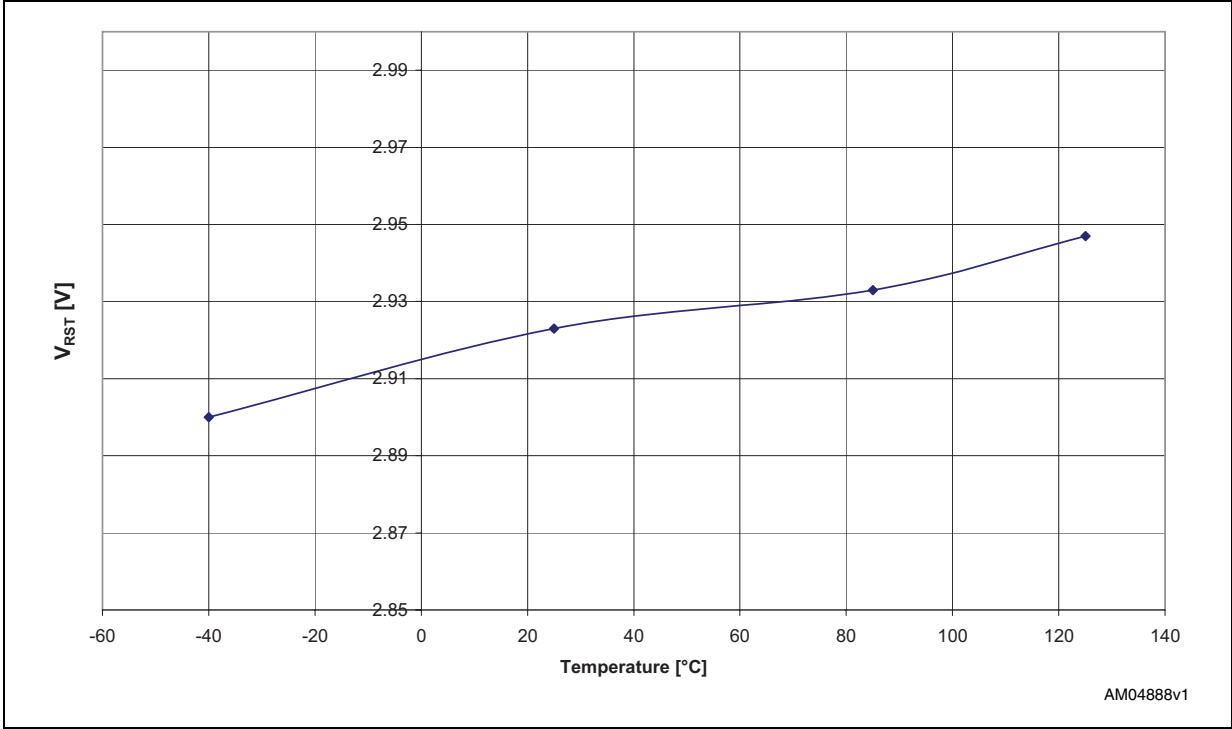
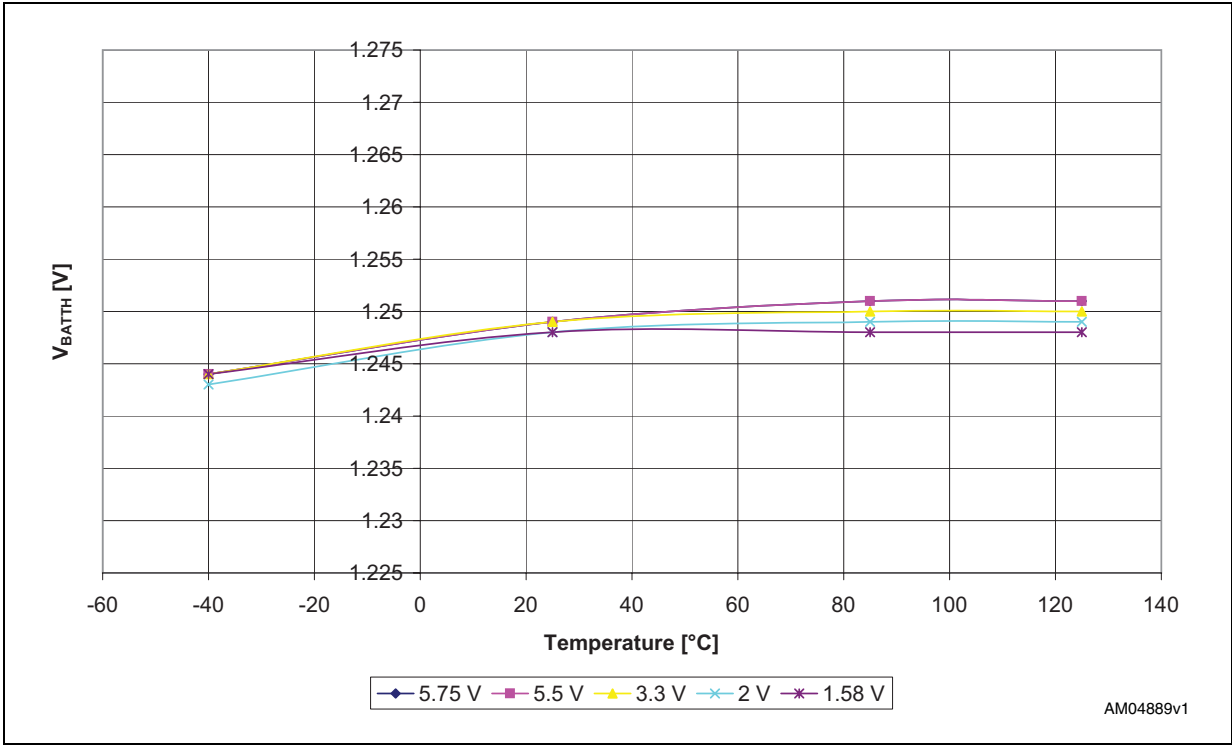


Figure 13.  $V_{BAT}$  monitoring threshold ( $V_{BATTH}$ ) vs. temperature, falling (STM6505)



### 3 Maximum ratings

Stressing the device above the rating listed in [Table 4: 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 4. 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   |
| $\theta_{JA}$   | Thermal resistance (junction to ambient) | TDFN8 | 149.0                      | °C/W |
| $V_{IO}$        | Input or output voltage                  |       | -0.3 to 5.5 <sup>(2)</sup> | V    |
| $V_{CC}$        | Supply voltage                           |       | -0.3 to 7                  | V    |

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

2. For inputs or outputs with internal pull-up resistors and push-pull type outputs -0.3 to  $V_{CC}+0.3$  V only.

4 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 5: Operating and measurement conditions](#). Designers should check that the operating conditions in their circuit match the operating conditions when relying on the quoted parameters.

Table 5. Operating and measurement conditions

| Parameter                                       | Value                      | 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 14. AC testing input/output waveforms

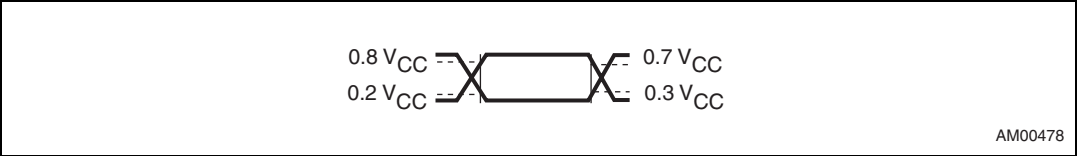


Table 6. DC and AC characteristics

| Symbol                                      | Parameter                                                                                                  | Test conditions <sup>(1)</sup>                                                                                     |                                                       | Min.                   | Typ. <sup>(2)</sup> | Max.                   | Unit |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|------------------------|---------------------|------------------------|------|
| V <sub>CC</sub>                             | Supply voltage range                                                                                       | Reset output valid - active-low                                                                                    |                                                       | 1.0                    |                     | 5.5                    | V    |
| I <sub>CC</sub>                             | Supply current (inputs in their inactive state, t <sub>REC</sub> and t <sub>SRC</sub> counter is inactive) | STM6502                                                                                                            | V <sub>CC</sub> = 5.0 V                               |                        | 1.2                 |                        | μA   |
|                                             |                                                                                                            |                                                                                                                    | V <sub>CC</sub> = 3.0 V <sup>(3)</sup>                |                        | 1.1                 |                        | μA   |
|                                             |                                                                                                            | STM6503                                                                                                            | V <sub>CC</sub> = 5.0 V, TSR left open                |                        | 4                   | 5.8                    | μA   |
|                                             |                                                                                                            |                                                                                                                    | V <sub>CC</sub> = 3.0 V, TSR left open <sup>(3)</sup> |                        | 3                   |                        | μA   |
|                                             |                                                                                                            | STM6504                                                                                                            | V <sub>CC</sub> = 5.0 V, TSR left open                |                        | 4                   | 5.8                    | μA   |
|                                             |                                                                                                            |                                                                                                                    | V <sub>CC</sub> = 3.0 V, TSR left open <sup>(3)</sup> |                        | 3                   |                        | μA   |
|                                             |                                                                                                            | STM6505                                                                                                            | V <sub>CC</sub> = 5.0 V                               |                        | 2.3                 | 3.3                    | μA   |
|                                             |                                                                                                            |                                                                                                                    | V <sub>CC</sub> = 3.0 V <sup>(3)</sup>                |                        | 2.2                 |                        | μA   |
| Output characteristics                      |                                                                                                            |                                                                                                                    |                                                       |                        |                     |                        |      |
| V <sub>OL</sub>                             | Reset output voltage low (reset asserted: $\overline{RST}$ , $\overline{BLD}$ )                            | V <sub>CC</sub> ≥ 4.5 V, sinking 3.2 mA                                                                            |                                                       |                        |                     | 0.3                    | V    |
|                                             |                                                                                                            | V <sub>CC</sub> ≥ 3.3 V, sinking 2.5 mA                                                                            |                                                       |                        |                     | 0.3                    | V    |
|                                             |                                                                                                            | V <sub>CC</sub> ≥ 1.0 V, sinking 0.1 mA                                                                            |                                                       |                        |                     | 0.3                    | V    |
| t <sub>REC</sub>                            | Reset timeout delay, factory-programmed                                                                    | Option A                                                                                                           |                                                       | 140                    | 210                 | 280                    | ms   |
|                                             |                                                                                                            | Option B                                                                                                           |                                                       | 240                    | 360                 | 480                    | ms   |
| V <sub>CC</sub> monitoring reset thresholds |                                                                                                            |                                                                                                                    |                                                       |                        |                     |                        |      |
| V <sub>RST</sub>                            | Fixed voltage trip point for V <sub>CC</sub> monitoring (refer to <a href="#">Table 7</a> )                | −40 to +85 °C                                                                                                      |                                                       | V <sub>RST</sub> −2.5% | V <sub>RST</sub>    | V <sub>RST</sub> +2.5% | V    |
|                                             |                                                                                                            | 25 °C                                                                                                              |                                                       | V <sub>RST</sub> −2.0% | V <sub>RST</sub>    | V <sub>RST</sub> +2.0% | V    |
| V <sub>HYST</sub>                           | Hysteresis of V <sub>RST</sub>                                                                             | L, M                                                                                                               |                                                       |                        | 0.5%                |                        |      |
|                                             |                                                                                                            | T, S, R, Z, Y, W, V                                                                                                |                                                       |                        | 1%                  |                        |      |
|                                             | V <sub>CC</sub> to reset delay                                                                             | V <sub>CC</sub> falling from (V <sub>RST</sub> + 100 mV) to (V <sub>RST</sub> - 100 mV) at 10 mV/μs <sup>(4)</sup> |                                                       |                        | 20                  |                        | μs   |
| V <sub>BAT</sub> monitoring                 |                                                                                                            |                                                                                                                    |                                                       |                        |                     |                        |      |
| V <sub>BATTH</sub>                          | Fixed V <sub>BAT</sub> monitoring threshold                                                                | STM6505 only                                                                                                       |                                                       | 1.225                  | 1.25                | 1.275                  | V    |
| V <sub>BATHYST</sub>                        | V <sub>BATTH</sub> hysteresis                                                                              | STM6505 only                                                                                                       |                                                       |                        | 8                   | 16                     | mV   |
| I <sub>LI(VBAT)</sub>                       | V <sub>BAT</sub> input leakage current                                                                     | STM6505 only                                                                                                       |                                                       | −100                   | 10                  | 100                    | nA   |

Table 6. DC and AC characteristics (continued)

| Symbol                    | Parameter                                                                                              | Test conditions <sup>(1)</sup>           | Min.                      | Typ. <sup>(2)</sup>         | Max.                      | Unit |
|---------------------------|--------------------------------------------------------------------------------------------------------|------------------------------------------|---------------------------|-----------------------------|---------------------------|------|
| <b>Smart Reset inputs</b> |                                                                                                        |                                          |                           |                             |                           |      |
| $V_{IL}$                  | $\overline{SR0}$ , $\overline{SR1}$ , SRE input voltage low                                            |                                          | $V_{SS}$<br>−0.3          |                             | 0.3<br>$V_{CC}$           | V    |
| $V_{IH}$                  | $\overline{SR0}$ , $\overline{SR1}$ , SRE input voltage high                                           |                                          | 0.7<br>$V_{CC}$           |                             | 5.5                       | V    |
| $I_{LI(SR)}$              | Input leakage current, $\overline{SR}$ and SRE inputs                                                  | Option without internal pull-up resistor | −1                        |                             | +1                        | μA   |
| $I_{LI(TSR)}$             | Input leakage current, TSR input                                                                       | STM6503 and STM6504 only                 | −5                        |                             | +7                        | μA   |
| $R_{PUI}$                 | Internal pull-up resistor, input (optional - refer to <a href="#">Table 12</a> )                       |                                          |                           | 65                          |                           | kΩ   |
| $t_{DEBOUNCE}$            | SRE input falling edge debounce time                                                                   | STM6504 only                             | 240                       | 360                         | 480                       | ms   |
| <b>Smart Reset delay</b>  |                                                                                                        |                                          |                           |                             |                           |      |
| $t_{SRC}^{(5)}$           | Capacitor-programmable Smart Reset setup time, STM6502 and STM6505. Refer to <a href="#">Table 3</a> . | $T_A = 25\text{ °C}$                     | 10 x<br>$C_{SRC}$<br>(μF) | 12.5 x<br>$C_{SRC}$<br>(μF) | 15 x<br>$C_{SRC}$<br>(μF) | s    |
| $t_{SRC}^{(5)}$           | TSR pin-programmable Smart Reset setup time, STM6503 and STM6504.                                      | TSR = $V_{SS}$                           | 2                         | 2.5                         | 3                         | s    |
|                           |                                                                                                        | TSR = floating <sup>(6)</sup>            | 6                         | 7.5                         | 9                         | s    |
|                           |                                                                                                        | TSR = $V_{CC}$                           | 10                        | 12.5                        | 15                        | s    |

1. Valid for ambient operating temperature:  $T_A = -40$  to  $+85\text{ °C}$ ;  $V_{CC} = 1.0$  to  $5.5\text{ V}$  (except where noted).

2. Typical value is at  $25\text{ °C}$  and  $V_{CC} = 3.3\text{ V}$  unless otherwise noted.

3. For devices with  $V_{RST} < 3.0\text{ V}$ .

4. Guaranteed by design.

5. Input glitch immunity is equal to  $t_{SRC}$  (when both  $\overline{SR}$  inputs are low, otherwise infinite). STM6502, STM6503, STM6505 only.

6. If left open, for improved system glitch immunity it is strongly recommended to connect a  $0.1\text{ μF}$  decoupling ceramic capacitor between the TSR and  $V_{SS}$  pins.

Table 7.  $V_{CC}$  voltage thresholds

| $V_{CC}$ monitoring threshold<br>$V_{RST}$ | Typ.  | $\pm 2.5\%$ ( $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ ) |       | $\pm 2.0\%$ ( $25\text{ }^{\circ}\text{C}$ ) |       | Unit |
|--------------------------------------------|-------|--------------------------------------------------------------------------------|-------|----------------------------------------------|-------|------|
|                                            |       | Min.                                                                           | Max.  | Min.                                         | Max.  |      |
| L (falling)                                | 4.625 | 4.509                                                                          | 4.741 | 4.533                                        | 4.718 | V    |
| M (falling)                                | 4.375 | 4.266                                                                          | 4.484 | 4.288                                        | 4.463 | V    |
| T (falling)                                | 3.075 | 2.998                                                                          | 3.152 | 3.014                                        | 3.137 | V    |
| S (falling)                                | 2.925 | 2.852                                                                          | 2.998 | 2.867                                        | 2.984 | V    |
| R (falling)                                | 2.625 | 2.559                                                                          | 2.691 | 2.573                                        | 2.678 | V    |
| Z (falling)                                | 2.313 | 2.255                                                                          | 2.371 | 2.267                                        | 2.359 | V    |
| Y (falling)                                | 2.188 | 2.133                                                                          | 2.243 | 2.144                                        | 2.232 | V    |
| W (falling)                                | 1.665 | 1.623                                                                          | 1.707 | 1.632                                        | 1.698 | V    |
| V (falling)                                | 1.575 | 1.536                                                                          | 1.614 | 1.544                                        | 1.607 | V    |

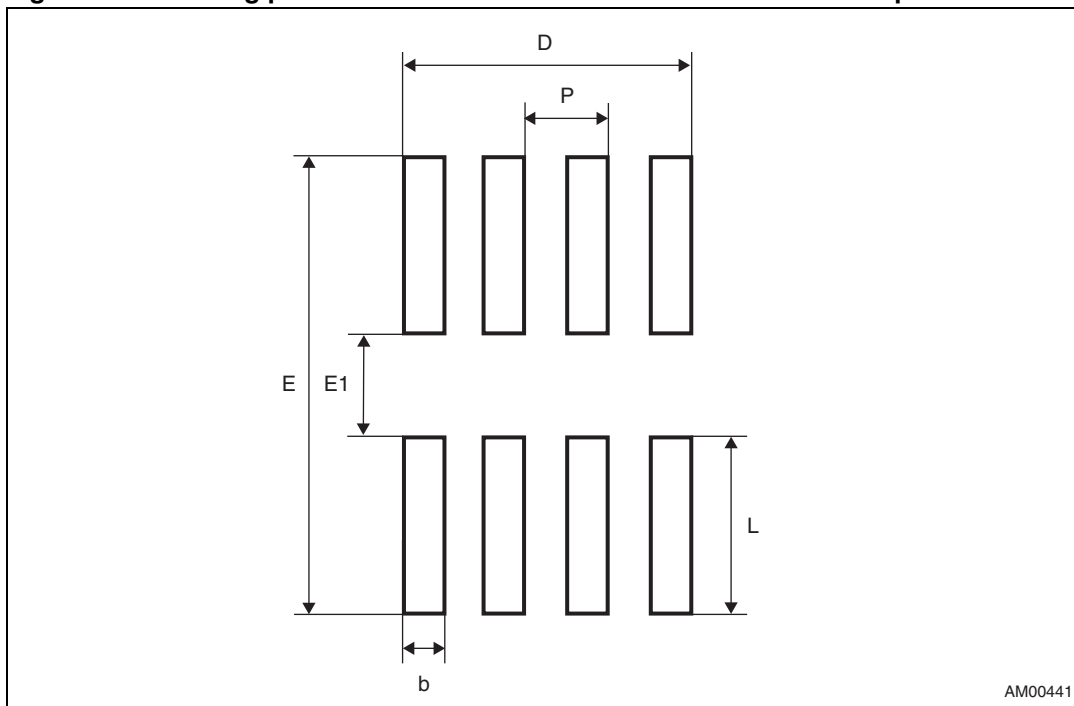
## 5 Package mechanical data

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.

The drawing consists of three views: TOP VIEW, SIDE VIEW, and BOTTOM VIEW.

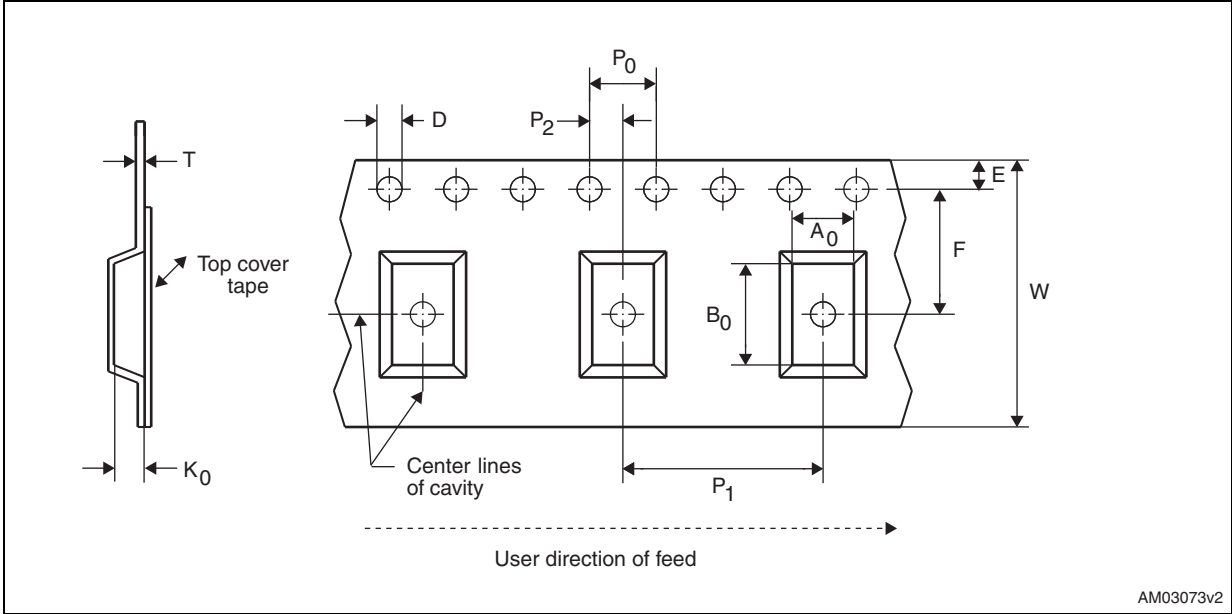
- TOP VIEW:** Shows a rectangular part with dimensions D (width) and E (height). A shaded area is labeled "PIN 1 INDEX AREA". A feature control frame at the bottom center contains a circular symbol, 0.10, C, and 2x. A feature control frame at the bottom left contains a circular symbol, 0.10, C, and 2x. Section lines A-A and B-B are indicated.
- SIDE VIEW:** Shows the profile of the part. A feature control frame at the top left contains a circular symbol, 0.10, and C. A feature control frame at the bottom left contains a circular symbol, 0.08, and C. A vertical dimension A is shown. A horizontal dimension A1 is shown. A feature control frame at the bottom right contains a circular symbol, C, and A. A "SEATING PLANE" is indicated.
- BOTTOM VIEW:** Shows the underside of the part. A shaded area is labeled "PIN 1 INDEX AREA". A feature control frame at the top center contains a circular symbol, 0.10, M, C, A, and B. A feature control frame at the bottom center contains a circular symbol, 0.10, M, C, A, and B. A feature control frame at the bottom right contains a circular symbol, 0.10, M, C, A, and B. Dimensions e, b, 1, 4, 8, 5, and L are shown.

| Symbol   | Dimension (mm) |      |      | Dimension (inches) |       |       |
|----------|----------------|------|------|--------------------|-------|-------|
|          | Min.           | Nom. | Max. | Min.               | Nom.  | Max.  |
| A        | 0.70           | 0.75 | 0.80 | 0.028              | 0.030 | 0.031 |
| A1       | 0.00           | 0.02 | 0.05 | 0.000              | 0.001 | 0.002 |
| b        | 0.15           | 0.20 | 0.25 | 0.006              | 0.008 | 0.010 |
| D<br>BSC | 1.9            | 2.00 | 2.1  | 0.075              | 0.079 | 0.083 |
| E<br>BSC | 1.9            | 2.00 | 2.1  | 0.075              | 0.079 | 0.083 |
| e        |                | 0.50 |      |                    | 0.020 |       |
| L        | 0.45           | 0.55 | 0.65 | 0.018              | 0.022 | 0.026 |

**Figure 16. Landing pattern - TDFN – 8-lead 2 x 2 mm without thermal pad****Table 9. Parameter for landing pattern - TDFN – 8-lead 2 x 2 mm package**

| Parameter | Description                   | Dimension (mm) |      |      |
|-----------|-------------------------------|----------------|------|------|
|           |                               | Min.           | Nom. | Max. |
| L         | Contact length                | 1.05           | —    | 1.15 |
| b         | Contact width                 | 0.25           | —    | 0.30 |
| E         | Max. land pattern Y-direction | —              | 2.85 | —    |
| E1        | Contact gap spacing           | —              | 0.65 | —    |
| D         | Max. land pattern X-direction | —              | 1.75 | —    |
| P         | Contact pitch                 | —              | 0.5  | —    |

Figure 17. Carrier tape



AM03073v2

Table 10. Carrier tape dimensions

| Package | W                      | D                       | E             | P <sub>0</sub> | P <sub>2</sub> | F             | A <sub>0</sub> | B <sub>0</sub> | K <sub>0</sub> | P <sub>1</sub> | T              | Unit | Bulk qty. |
|---------|------------------------|-------------------------|---------------|----------------|----------------|---------------|----------------|----------------|----------------|----------------|----------------|------|-----------|
| TDFN8   | 8.00<br>+0.30<br>-0.10 | 1.50<br>+0.10/<br>-0.00 | 1.75<br>±0.10 | 4.00<br>±0.10  | 2.00<br>±0.10  | 3.50<br>±0.05 | 2.30<br>±0.05  | 2.30<br>±0.05  | 1.00<br>±0.05  | 4.00<br>±0.10  | 0.250<br>±0.05 | mm   | 3000      |

Figure 18. Reel dimensions

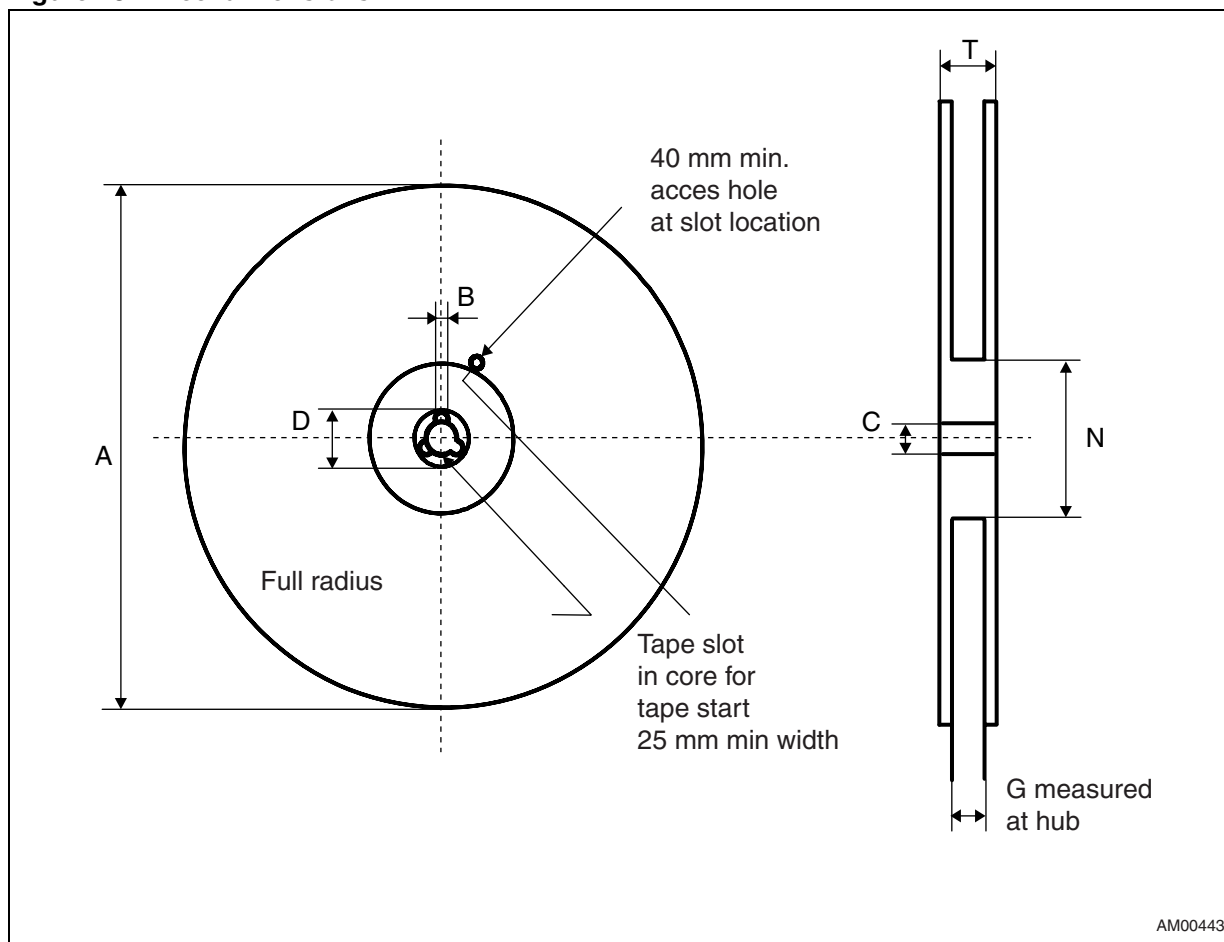


Table 11. Reel dimensions

| Tape sizes | A max.         | B min. | C               | D min. | N min. | G              | T max. |
|------------|----------------|--------|-----------------|--------|--------|----------------|--------|
| 8 mm       | 180 (7 inches) | 1.50   | 13.0 $\pm$ 0.20 | 20.20  | 60     | 8.4 $\pm$ 2/-0 | 14.40  |

Figure 19. Tape trailer/leader

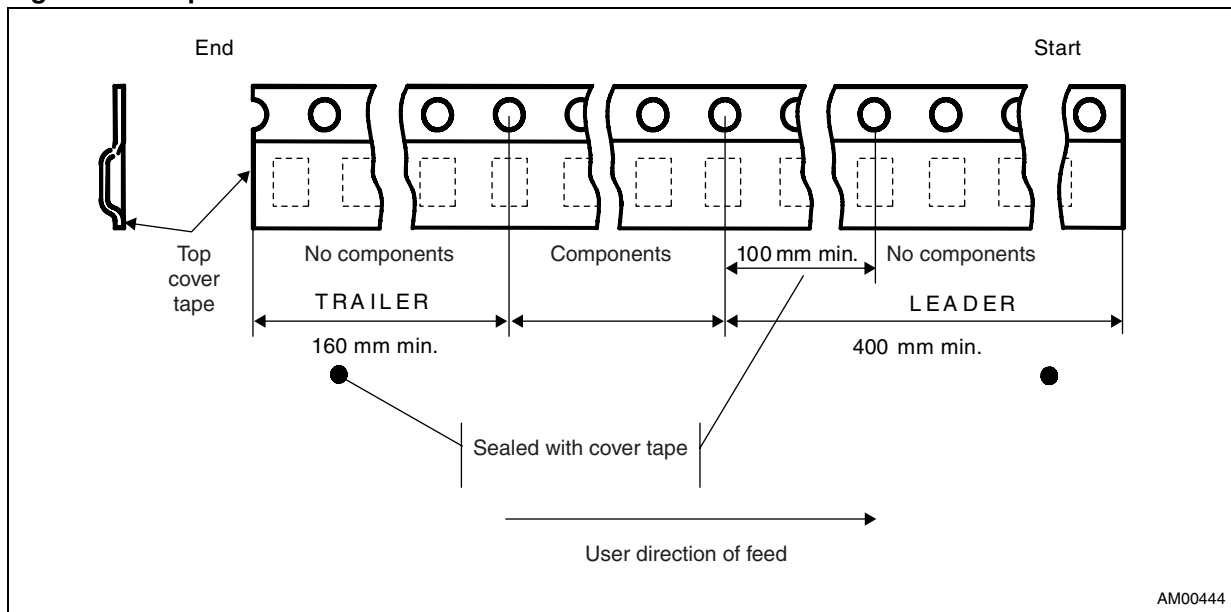
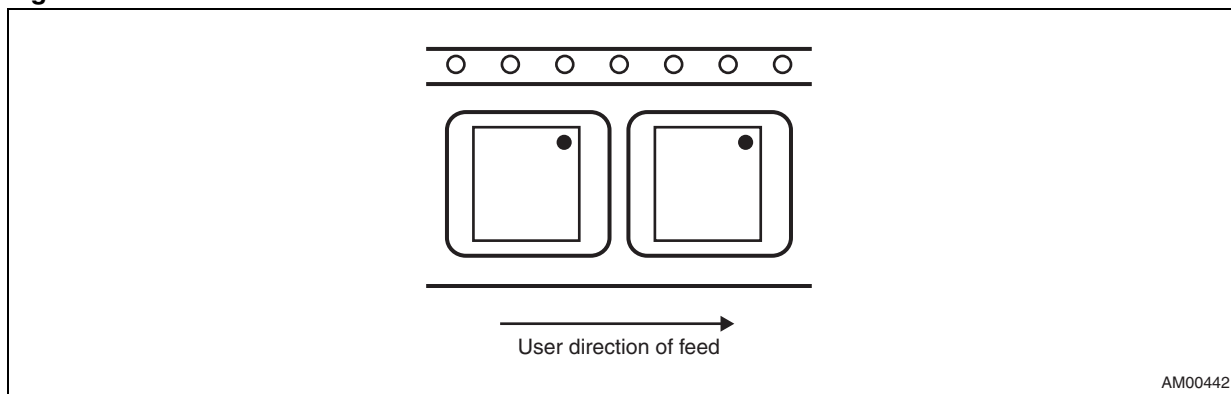


Figure 20. Pin 1 orientation



- Note:
- 1 Drawings are not to scale.
  - 2 All dimensions are in mm, unless otherwise noted.

## 6 Part numbering

**Table 12. Ordering information scheme**

| Example:                                                                                                                                               | STM6505 | W | C | A | B | DG | 6 | F |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---|---|---|---|----|---|---|
| <b>Device type</b>                                                                                                                                     |         |   |   |   |   |    |   |   |
| STM6502 <sup>(1)</sup>                                                                                                                                 |         |   |   |   |   |    |   |   |
| STM6503                                                                                                                                                |         |   |   |   |   |    |   |   |
| STM6504 <sup>(1)</sup>                                                                                                                                 |         |   |   |   |   |    |   |   |
| STM6505                                                                                                                                                |         |   |   |   |   |    |   |   |
| <b>Reset (<math>V_{CC}</math> monitoring) threshold voltage (<math>V_{RST}</math>), typ., falling</b>                                                  |         |   |   |   |   |    |   |   |
| L = 4.625 V                                                                                                                                            |         |   |   |   |   |    |   |   |
| S = 2.925 V                                                                                                                                            |         |   |   |   |   |    |   |   |
| R = 2.625 V                                                                                                                                            |         |   |   |   |   |    |   |   |
| Z = 2.313 V                                                                                                                                            |         |   |   |   |   |    |   |   |
| W = 1.665 V                                                                                                                                            |         |   |   |   |   |    |   |   |
| V = 1.575 V                                                                                                                                            |         |   |   |   |   |    |   |   |
| <b>Smart Reset setup delay (<math>t_{SRC}</math>); presence of internal input pull-up on all Smart Reset inputs (<math>\overline{SRx}</math>, SRE)</b> |         |   |   |   |   |    |   |   |
| A = user-programmable (external capacitor); no input pull-up                                                                                           |         |   |   |   |   |    |   |   |
| C = user-programmable (external capacitor); 65 k $\Omega$ input pull-up                                                                                |         |   |   |   |   |    |   |   |
| E = 2 or 6 or 10 s min., user-programmable (three-state); no input pull-up                                                                             |         |   |   |   |   |    |   |   |
| F = 2 or 6 or 10 s min., user-programmable (three-state); 65 k $\Omega$ input pull-up                                                                  |         |   |   |   |   |    |   |   |
| <b>Output type</b>                                                                                                                                     |         |   |   |   |   |    |   |   |
| A = open-drain, no pull-up, active-low                                                                                                                 |         |   |   |   |   |    |   |   |
| <b>Reset timeout period (<math>t_{REC}</math>)</b>                                                                                                     |         |   |   |   |   |    |   |   |
| A = 140 ms min.                                                                                                                                        |         |   |   |   |   |    |   |   |
| B = 240 ms min.                                                                                                                                        |         |   |   |   |   |    |   |   |
| <b>Package</b>                                                                                                                                         |         |   |   |   |   |    |   |   |
| DG = TDFN8 2 x 2 x 0.75 mm, 0.5 mm pitch                                                                                                               |         |   |   |   |   |    |   |   |
| <b>Temperature range</b>                                                                                                                               |         |   |   |   |   |    |   |   |
| 6 = -40 °C to +85 °C                                                                                                                                   |         |   |   |   |   |    |   |   |
| <b>Shipping method</b>                                                                                                                                 |         |   |   |   |   |    |   |   |
| F = ECOPACK <sup>®</sup> package, tape and reel                                                                                                        |         |   |   |   |   |    |   |   |

1. Contact local ST sales office for availability.

For device options currently available refer to [Table 13](#). For other options, voltage threshold values etc. or for more information on any aspect of this device, please contact the ST sales office nearest you.

## 7 Package marking

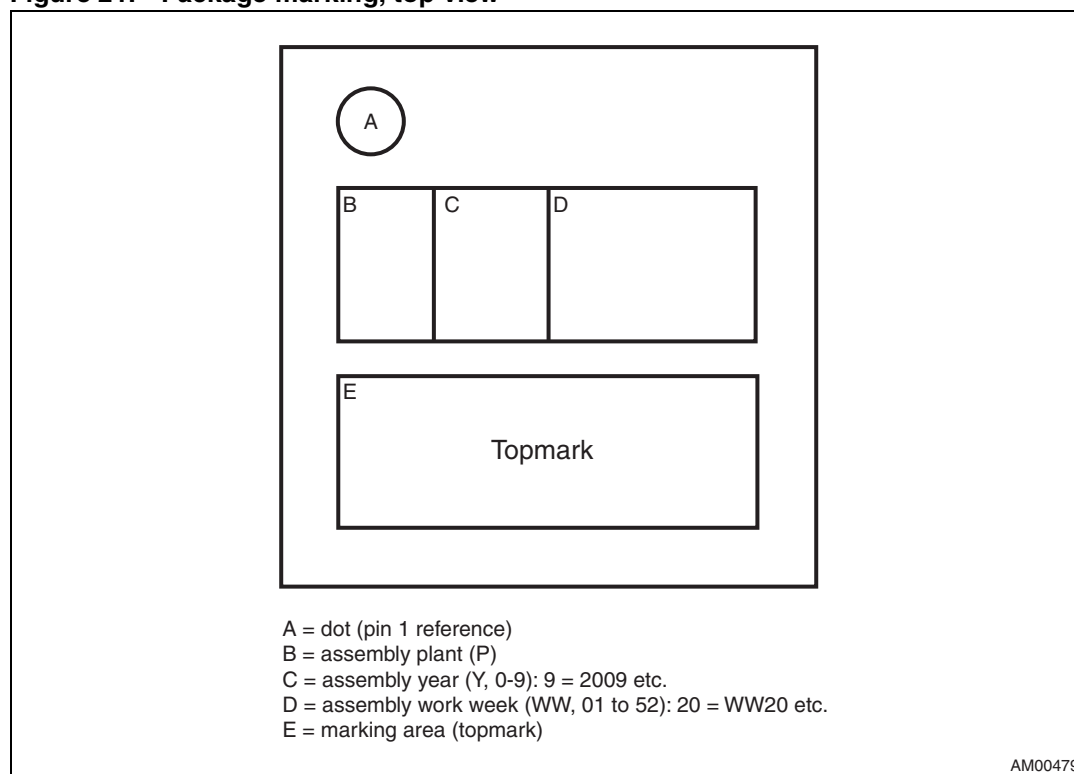
**Table 13. Package marking**

| Part number                    | t <sub>SRC</sub><br>delay<br>control | Smart<br>Reset<br>inputs <sup>(1)</sup> | V <sub>RST</sub> | $\overline{\text{RST}}$<br>output <sup>(1)</sup> | t <sub>REC</sub><br>option | $\overline{\text{BLD}}$<br>output <sup>(1)</sup> | Topmark |
|--------------------------------|--------------------------------------|-----------------------------------------|------------------|--------------------------------------------------|----------------------------|--------------------------------------------------|---------|
| STM6503REAADG6F                | TSR                                  | AL                                      | R                | AL, OD                                           | A                          | —                                                | 3RG     |
| STM6503SEAADG6F                | TSR                                  | AL                                      | S                | AL, OD                                           | A                          | —                                                | 3SG     |
| STM6503VEAADG6F                | TSR                                  | AL                                      | V                | AL, OD                                           | A                          | —                                                | 3VG     |
| STM6504SEABDG6F <sup>(2)</sup> | TSR                                  | AL                                      | S                | AL, OD                                           | B                          | —                                                | 4SG     |
| STM6505SCABDG6F                | C <sub>SRC</sub>                     | AL, PU                                  | S                | AL, OD                                           | B                          | AL, OD                                           | 5SK     |
| STM6505RCABDG6F                | C <sub>SRC</sub>                     | AL, PU                                  | R                | AL, OD                                           | B                          | AL, OD                                           | 5RK     |
| STM6505WCABDG6F                | C <sub>SRC</sub>                     | AL, PU                                  | W                | AL, OD                                           | B                          | AL, OD                                           | 5WK     |

1. AL = active-low, AH = active-high, PU = with internal pull-up resistor, OD = open-drain.

2. Contact local ST sales office for availability.

**Figure 21. Package marking, top view**



## 8 Revision history

**Table 14. Document revision history**

| Date        | Revision | Changes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 31-Aug-2009 | 1        | Initial release.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 06-Nov-2009 | 2        | Updated <a href="#">Applications</a> , <a href="#">Section 1</a> , <a href="#">Section</a> , <a href="#">Figure 3</a> to <a href="#">Figure 6</a> updated and moved to <a href="#">Section</a> , updated <a href="#">Table 1</a> , <a href="#">Table 2</a> , <a href="#">Table 3</a> , <a href="#">Table 4</a> , <a href="#">Table 6</a> , <a href="#">Table 12</a> , <a href="#">Section 1.2.3</a> , <a href="#">Section 1.2.7</a> , <a href="#">Section 1.2.9</a> , <a href="#">Section 5</a> , added package footprint, tape and reel information, and <a href="#">Section 7</a> . |
| 15-Jan-2010 | 3        | Updated <a href="#">Features</a> , <a href="#">Section 1</a> , <a href="#">Section 1.2.6</a> , <a href="#">Table 1</a> , <a href="#">Table 2</a> , <a href="#">Figure 5</a> , <a href="#">Figure 6</a> , <a href="#">Table 3</a> , <a href="#">Table 6</a> , <a href="#">Table 12</a> , <a href="#">Table 13</a> , removed <a href="#">Table 4</a> .                                                                                                                                                                                                                                  |
| 01-Mar-2010 | 4        | Updated title of datasheet, <a href="#">Features</a> , <a href="#">Applications</a> , <a href="#">Table 1</a> , <a href="#">2</a> , <a href="#">6</a> , <a href="#">12</a> , footnote <a href="#">5</a> of <a href="#">Table 6</a> ; updated <a href="#">Figure 3</a> , <a href="#">4</a> ; added <a href="#">Section 2: Typical operating characteristics</a> ; minor textual and formatting changes.                                                                                                                                                                                |
| 21-Jun-2010 | 5        | Updated <a href="#">Features</a> , <a href="#">Section 1</a> , <a href="#">Figure 8</a> , footnote <a href="#">1</a> and <a href="#">2</a> of <a href="#">Table 3</a> , updated <a href="#">Table 4</a> , added footnote <a href="#">2</a> to <a href="#">Table 4</a> , <a href="#">Table 6</a> , added footnote <a href="#">6</a> to <a href="#">Table 6</a> , updated <a href="#">Table 6</a> to <a href="#">Table 9</a> , and added footnote <a href="#">2</a> of <a href="#">Table 13</a> .                                                                                       |
| 09-Feb-2011 | 6        | Reformatted <a href="#">Table 1</a> , updated <a href="#">Table 6</a> , added STM6503REAADG6F and STM6503SEAADG6F device to <a href="#">Table 13</a> , corrected typo in <a href="#">Table 13</a> .                                                                                                                                                                                                                                                                                                                                                                                   |

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