

## 6 pin Smart Reset™

Datasheet - production data



UDFN6 (1.6 x 1.3 mm)

## Applications

- Wearable
- Activity tracker
- Smartwatch
- Smartglasses

## Features

- Operating voltage 1.65 V to 5.5 V
- Low supply current 1.5  $\mu$ A
- Integrated test mode
- Dual Smart Reset™ push-button inputs with fixed extended reset setup delay ( $t_{SRC}$ ) from 0.5 s to 10 s in 0.5 s steps (typ.), option with internal pull-up resistor
- Push-button controlled reset pulse duration
  - Option 1: fully push-button controlled, no fixed or minimum pulse width guaranteed
  - Option 2: defined output reset pulse duration ( $t_{REC}$ ), factory-programmed
- No power-on reset
- Single reset output
  - Active low or active high
  - Push-pull or open drain with optional pull-up resistor
- Fixed Smart Reset™ input logic voltage levels
- Operating temperature: - 40 °C to +85 °C
- UDFN6 package: 1.6 mm x 1.3 mm
- ECOPACK® 2 (RoHS compliant, Halogen-Free)

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# 1 Description

The Smart Reset™ devices provide 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 time ( $t_{SRC}$ ) and combined push-button inputs, which together ensures a safe reset and eliminates the need for a specific dedicated reset button.

This reset configuration provides versatility and allows the application to distinguish between a software generated interrupt and a hard system reset. When the input push-button are connected to microcontroller interrupt inputs, and are closed for a short time, the processor can only be interrupted. If the system still does not respond properly, continuing to keep the push-button closed for the extended setup time  $t_{SRC}$  causes a hard reset of the processor through the reset output.

The SR2 has two combined delayed Smart Reset™ inputs ( $\overline{SR0}$ ,  $\overline{SR1}$ ) with preset delayed Smart Reset™ setup time ( $t_{SRC}$ ). The reset output is asserted after both of the Smart Reset™ inputs were held active for the selected  $t_{SRC}$  delay time. Depending on selected option the  $\overline{RST}$  output remains asserted either until at least one  $\overline{SR}$  input goes to inactive logic level (i.e. neither fixed nor minimum reset pulse width is set) or the output reset pulse duration is fixed for  $t_{REC}$  (i.e. factory-programmed). The reset output,  $\overline{RST}$ , is active low or active high, push-pull or open drain with optional pull-up resistor. The device fully operates over a broad  $V_{CC}$  range 1.65 V to 5.5 V. Below 1.575 V typ. the inputs are ignored and outputs are deasserted; the deasserted reset output levels are then valid down to 1.0 V.

## 1.1 Test mode

After pull of  $\overline{SR0}$  up to  $V_{TEST}$  or more ( $V_{CC} + 1.4$  V, max.) we start counting initial shorten  $t_{SRC-INI}$  (42 ms, typ.). After  $t_{SRC-INI}$  expires, the  $\overline{RST}$  output either goes down for  $t_{REC}$  (if  $t_{REC}$  option is used) or stays low as long as overvoltage on  $\overline{SR0}$  is detected (if  $t_{REC}$  option is not used). This is a feedback and a user knows that the device is locked in the test mode. Each time both  $\overline{SR}$  inputs are connected to ground in test mode a shorten  $t_{SRC-SHORT}$  (21 ms, typ.) is used instead of long  $t_{SRC}$  (0.5 s -10 s). Return from to normal mode is possible by a new startup of the device (i.e.  $V_{CC}$  goes to 0 V and back to its original state). In this way the device can be quickly tested without repeating test mode triggering. Advantage of this solution is pretty high glitch immunity, feedback to user about entry to the test mode and testability within full  $V_{CC}$  range.

Figure 1. Logic diagram

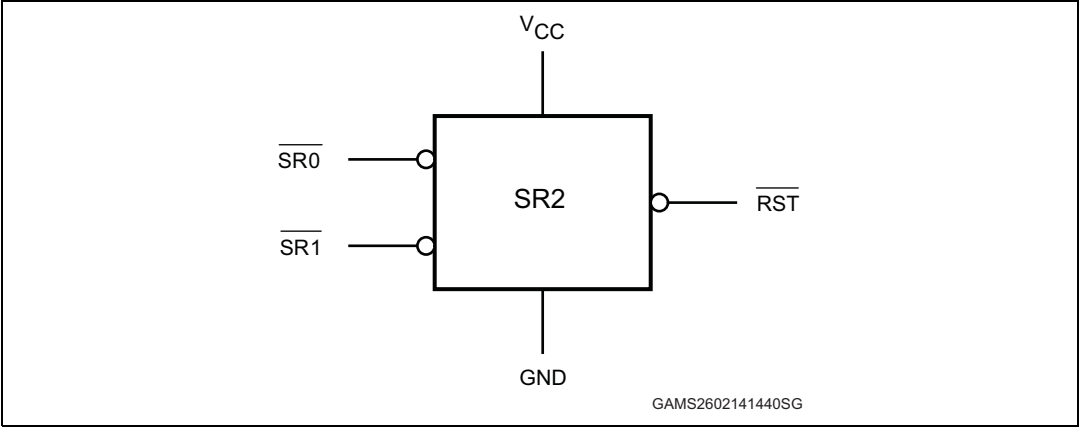


Figure 2. Pin connections (top view)

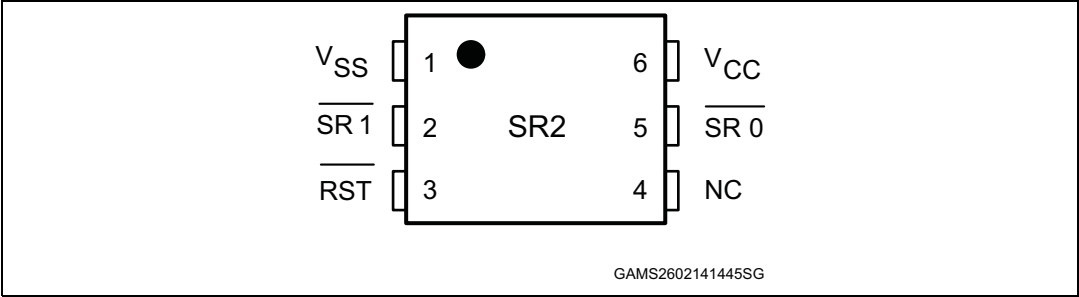
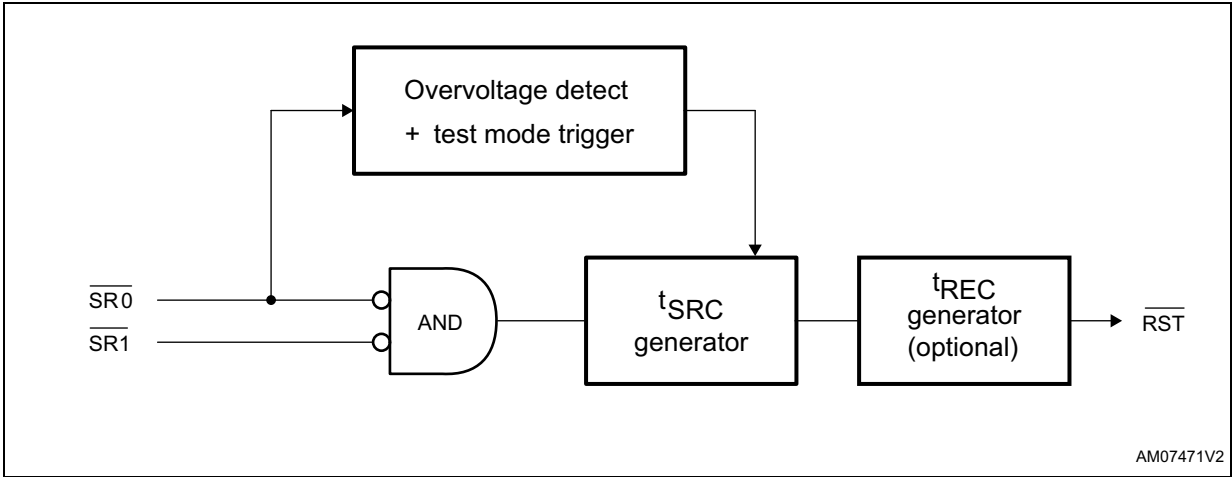


Table 1. Signal names

| Pin | Name                    | Type           | Description                                                                                                                                                                                           |
|-----|-------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | V <sub>SS</sub>         | Supply ground  | Ground                                                                                                                                                                                                |
| 2   | $\overline{\text{SR1}}$ | Input          | Secondary push-button Smart Reset™ input. Active low. Optional pull-up resistor                                                                                                                       |
| 3   | $\overline{\text{RST}}$ | Output         | Reset output<br>(open drain with optional pull-up resistor, active low)<br>(push-pull – active low or active high)                                                                                    |
| 4   | NC                      | -              | Not connected (not bonded; should be connected to V <sub>SS</sub> )                                                                                                                                   |
| 5   | $\overline{\text{SR0}}$ | Input          | Primary push-button Smart Reset™ input. Active low. Optional pull-up resistor                                                                                                                         |
| 6   | V <sub>CC</sub>         | Supply voltage | Positive supply voltage for the device. A 0.1 μF decoupling ceramic capacitor is recommended to be connected between V <sub>CC</sub> and V <sub>SS</sub> pins, as close to the SR2 device as possible |

Figure 3. Block diagram



## 2 Pin descriptions

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

This pin is used to provide power to the Smart Reset™ device. A 0.1  $\mu$ F ceramic decoupling capacitor is recommended to be connected between the  $V_{CC}$  and  $V_{SS}$  pins, as close to the SR2 device as possible.

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

Ground pin for the device.

### 2.3 Smart Reset™ input ( $\overline{SR0}$ )

Push-button Smart Reset™ input is active low with optional pull-up resistor. Both  $\overline{SR}$  inputs need to be asserted simultaneously for at least  $t_{SRC}$  to assert the reset output ( $\overline{RST}$ ). By connecting a voltage higher than  $V_{CC}$  to the  $\overline{SR0}$  the device enters a test mode (see [Section 1: Description on page 3](#) for more information).

### 2.4 Smart Reset™ input ( $\overline{SR1}$ )

Push-button Smart Reset™ input is active low with optional pull-up resistor. Both  $\overline{SR}$  inputs need to be asserted simultaneously for at least  $t_{SRC}$  to assert the reset output ( $\overline{RST}$ ).

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

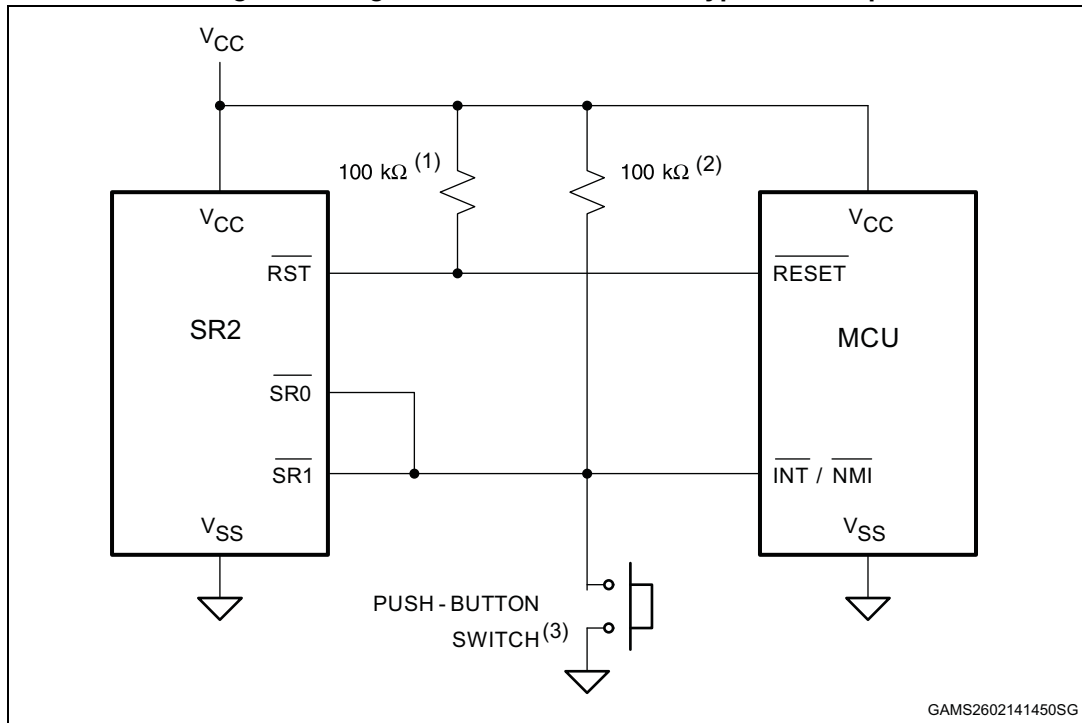
$\overline{RST}$  is active low or active high, push-pull or open drain reset output with optional internal pull-up resistor. Output reset pulse width is optional as follows:

- Neither fixed nor minimum output reset pulse duration (releasing the push-button while reset output is active, causes the output to deassert);
- Fixed, factory-programmed output reset pulse duration for  $t_{REC}$  independent on Smart Reset™ input state.

If  $V_{CC}$  drops below 1.575 V, the  $\overline{RST}$  output is deasserted and its state is guaranteed down to 1 V (see [Figure 8](#)).

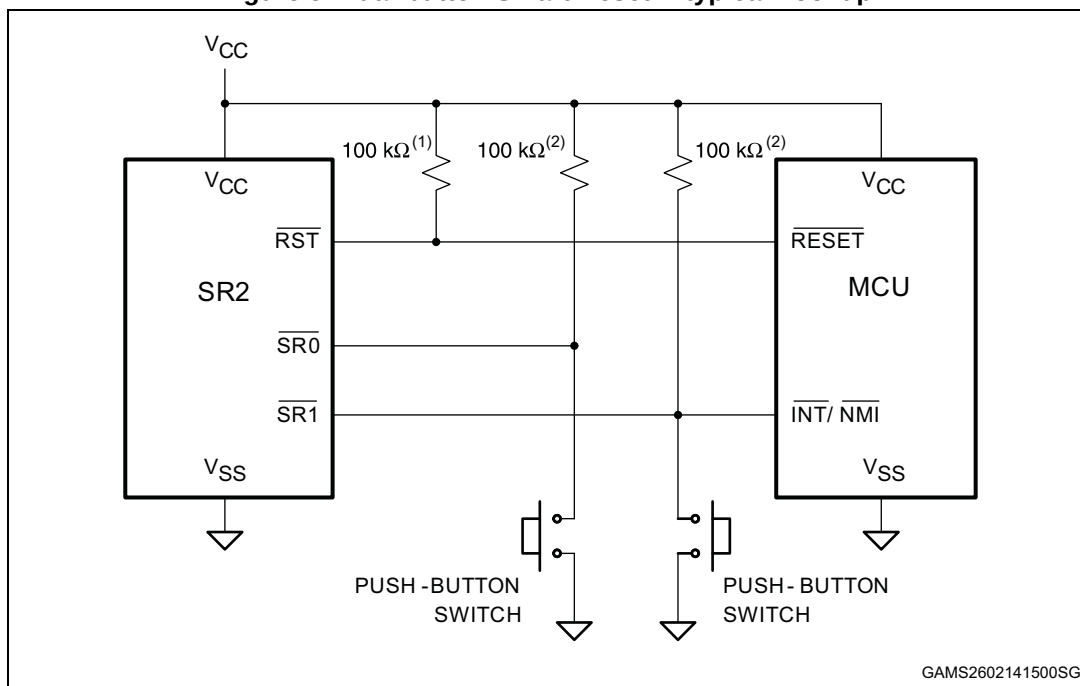
### 3 Typical application diagram

Figure 4. Single-button Smart Reset™ typical hookup



1. External pull-up resistor requested if the reset output ( $\overline{\text{RST}}$ ) is open drain type without internal pull-up.
2. External pull-up resistor requested if the Smart Reset™ inputs ( $\overline{\text{SR0}}$  and  $\overline{\text{SR1}}$ ) have no internal pull-up.
3. When only one Smart Reset™ input push-button is used, tie both the  $\overline{\text{SR}}$  inputs together.

Figure 5. Dual-button Smart Reset™ typical hookup



1. External pull-up resistor requested if the reset output ( $\overline{\text{RST}}$ ) is open drain type without internal pull-up.
2. External pull-up resistor requested if the Smart Reset™ inputs ( $\overline{\text{SR0}}$  and  $\overline{\text{SR1}}$ ) have no internal pull-up.



## 4 Timing waveforms

Figure 6. Option without  $t_{REC}$

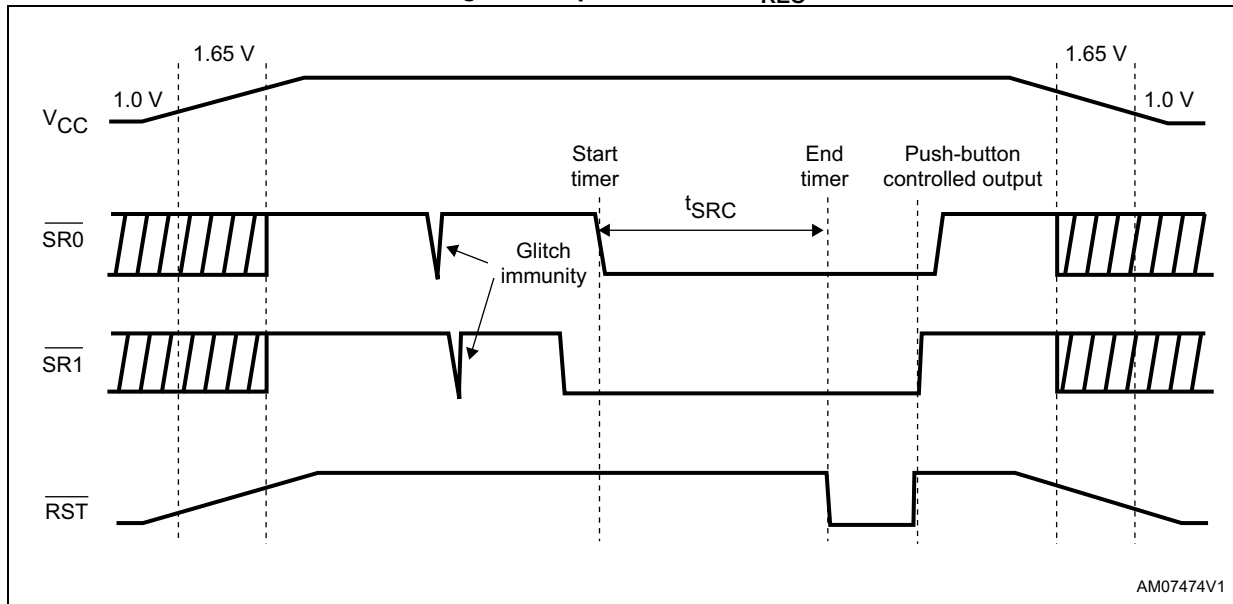


Figure 7. Option with  $t_{REC}$

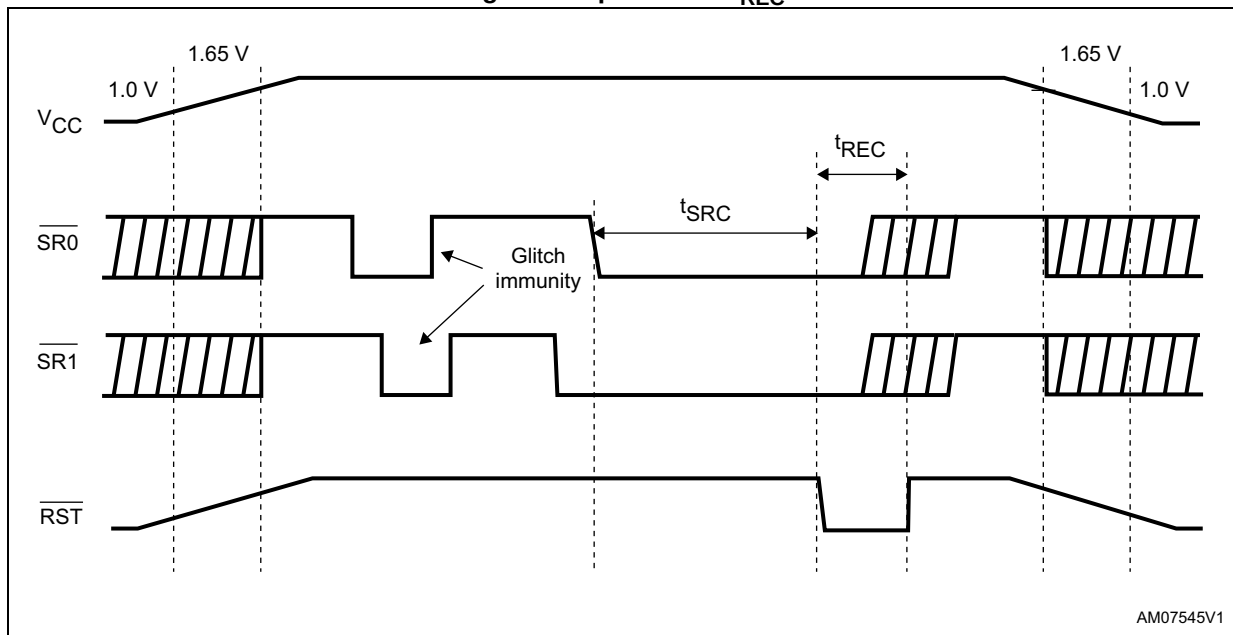
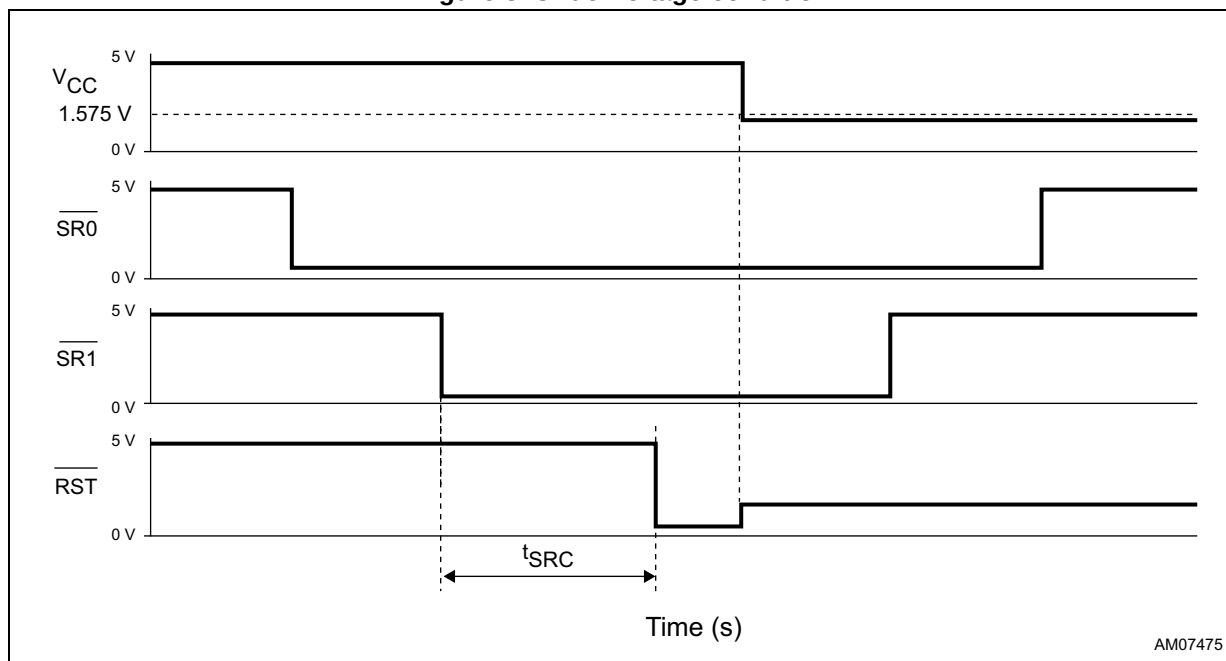


Figure 8. Undervoltage condition



1. If undervoltage occurs ( $V_{CC}$  drops below 1.575 V typ.) while reset output is active, the reset output is released and goes inactive.

## 5 Typical operating characteristics

Figure 9. Supply current ( $I_{CC}$ ) vs. temperature ( $T_A$ )

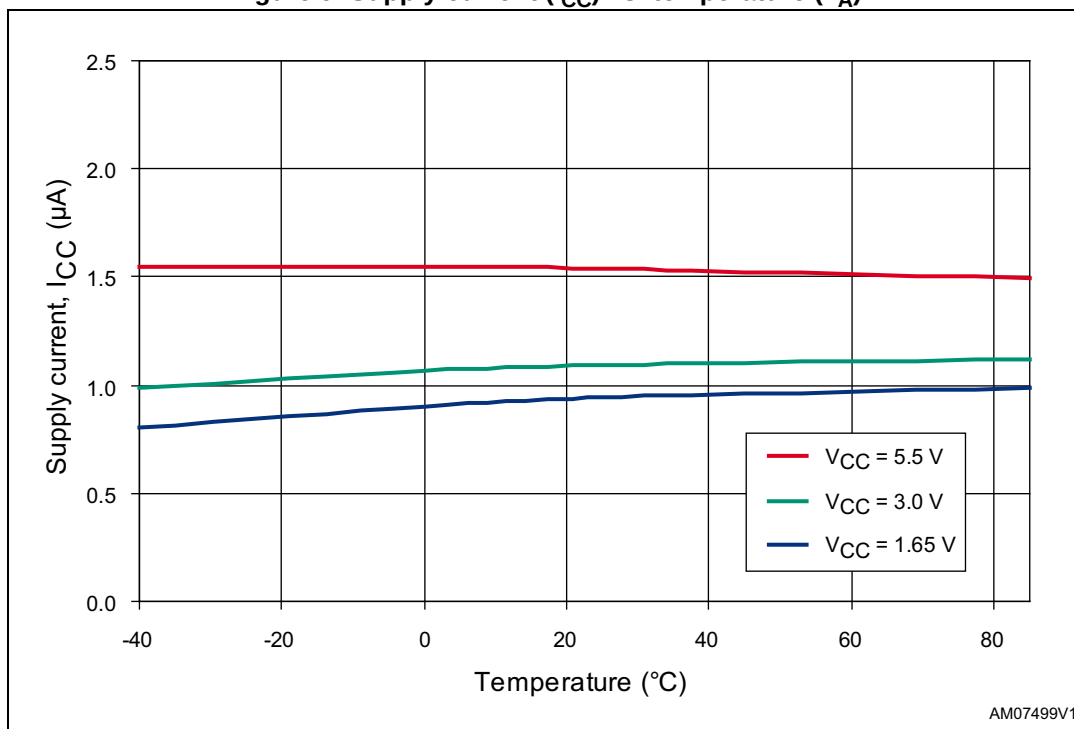


Figure 10. Smart Reset™ delay ( $t_{SRC}$ ) vs. temperature ( $T_A$ ),  $t_{SRC} = 7.5 s$  (typ.)

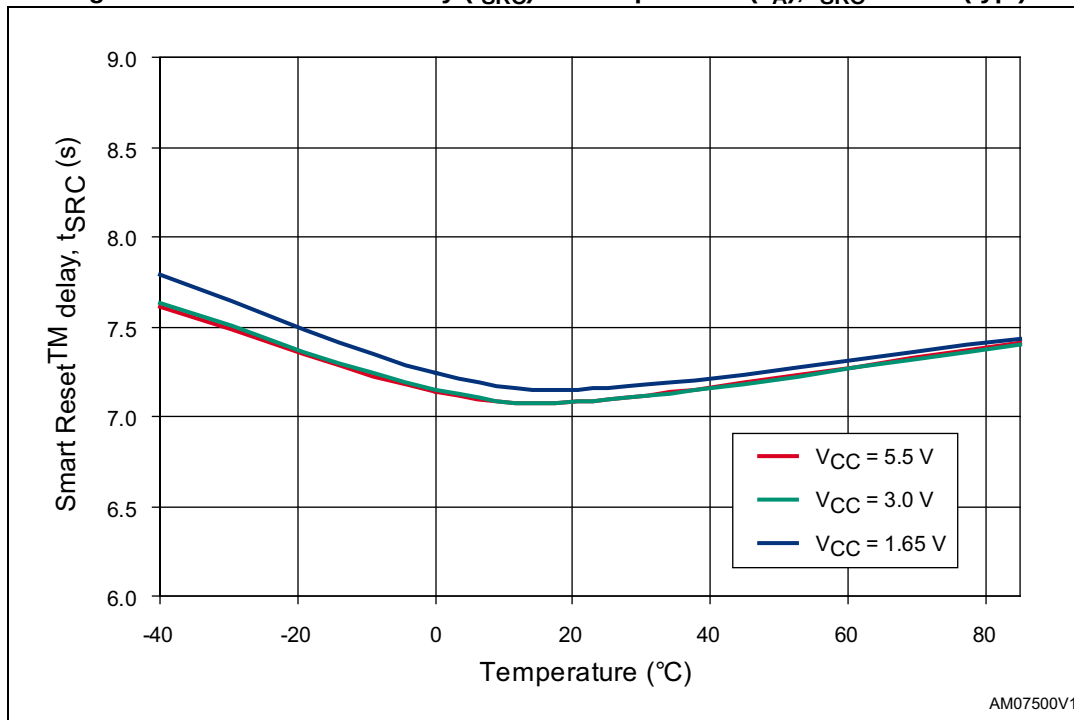


Figure 11. Test mode entry voltage ( $V_{TEST}$ ) vs. temperature ( $T_A$ )

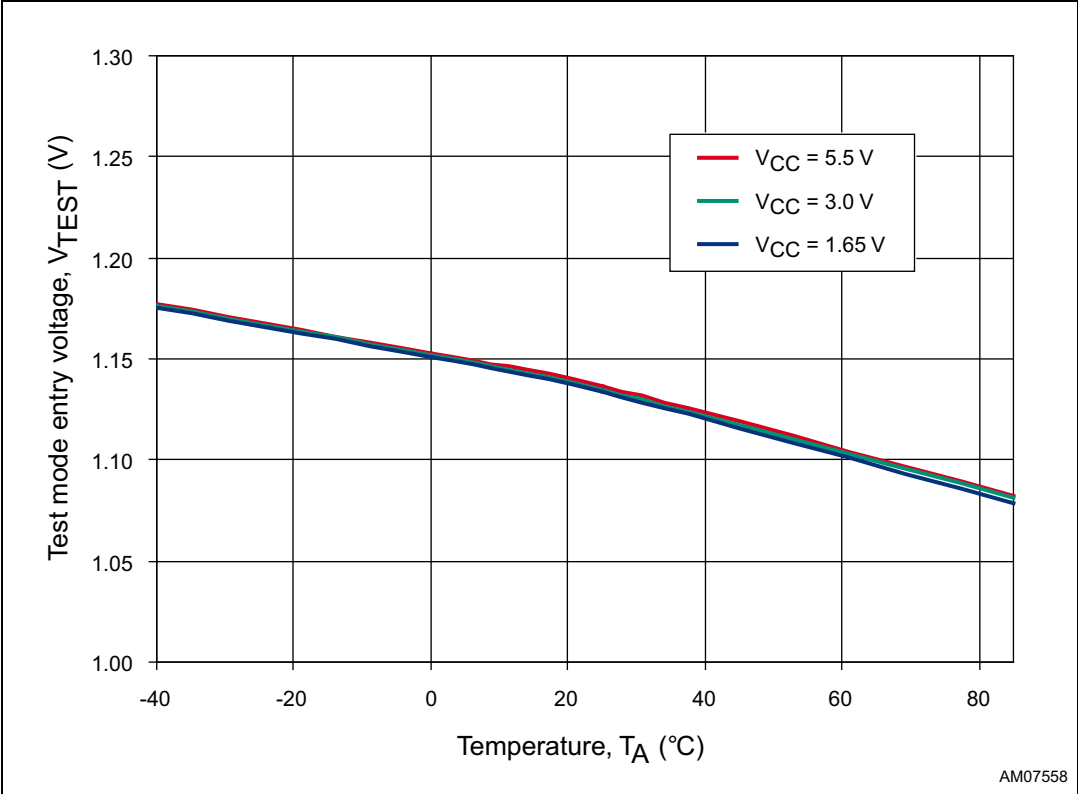
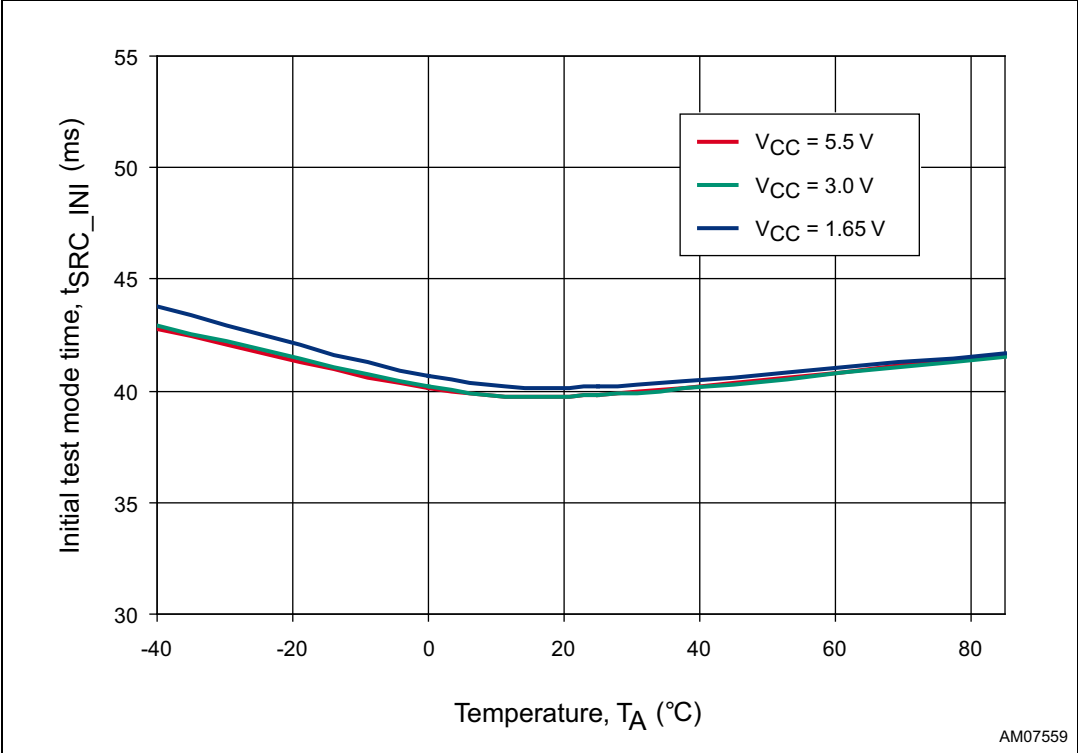


Figure 12. Initial test mode time ( $t_{SRC\_INI}$ ) vs. temperature ( $T_A$ )



## 6 Maximum ratings

Stressing the device above the rating listed in [Table 2: Absolute maximum ratings](#) may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those indicated in [Table 3: Operating and measurement conditions](#) of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Refer also to the STMicroelectronics™ SURE program and other relevant quality documents.

**Table 2. Absolute maximum ratings**

| Symbol                          | Parameter                                                                           | Value                      | Unit |
|---------------------------------|-------------------------------------------------------------------------------------|----------------------------|------|
| T <sub>STG</sub>                | Storage temperature (V <sub>CC</sub> off)                                           | -55 to +150                | °C   |
| T <sub>SLD</sub> <sup>(1)</sup> | Lead solder temperature for 10 seconds                                              | 260                        | °C   |
| V <sub>IO</sub>                 | Input or output voltage                                                             | -0.3 to 5.5 <sup>(2)</sup> | V    |
| V <sub>CC</sub>                 | Supply voltage                                                                      | -0.3 to 7                  | V    |
| <b>ESD</b>                      |                                                                                     |                            |      |
| V <sub>HBM</sub>                | Electrostatic discharge protection, human body model (JESD22-A114-B level 2)        | 2                          | kV   |
| V <sub>RCDM</sub>               | Electrostatic discharge protection, charged device model, all pins                  | 1                          | kV   |
| V <sub>MM</sub>                 | Electrostatic discharge protection, machine model, all pins (JESD22-A115-A level A) | 200                        | V    |
|                                 | Latch-up (V <sub>CC</sub> pin, $\overline{\text{SR0}}$ reset input pin)             | EIA/JESD78                 | -    |

1. Reflow at peak temperature of 260 °C. The time above 255 °C must not exceed 30 seconds.
2. For push-pull  $\overline{\text{RST}}$  output type only from -0.3 V to V<sub>CC</sub> +0.3 V.

## 7 DC and AC parameters

This section summarizes the operating measurement conditions, and the DC and AC characteristics of the device. The parameters in [Table 4: DC and AC characteristic](#) that follow, are derived from tests performed under the measurement conditions summarized in [Table 3: 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 3. Operating and measurement conditions**

| Symbol   | Parameter                     | Value       | Unit |
|----------|-------------------------------|-------------|------|
| $V_{CC}$ | Supply voltage                | 1.65 to 5.5 | V    |
| $T_A$    | Ambient operating temperature | -40 to +85  | °C   |

Table 4. DC and AC characteristic

| Symbol                 | Parameter                                                                                | Test conditions <sup>(1)</sup>                                                     | Min.                   | Typ. <sup>(2)</sup>             | Max.                   | Unit |
|------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------|---------------------------------|------------------------|------|
| V <sub>CC</sub>        | Supply voltage <sup>(3)</sup>                                                            |                                                                                    | 1.65                   |                                 | 5.5                    | V    |
| I <sub>CC</sub>        | Supply current (inputs in their inactive state, t <sub>SRC</sub> counter is not running) | V <sub>CC</sub> = 3.0 V                                                            |                        | 1.1                             | 2.5                    | μA   |
|                        |                                                                                          | V <sub>CC</sub> = 5.0 V                                                            |                        | 1.5                             | 3.0                    | μA   |
| V <sub>OL</sub>        | Reset output voltage low                                                                 | 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> ≥ 1.65 V, sinking 1 mA                                             |                        |                                 | 0.3                    | V    |
| V <sub>OH</sub>        | Reset output voltage high (push-pull output only)                                        | V <sub>CC</sub> ≥ 4.5 V, I <sub>SOURCE</sub> = 0.8 mA                              | 0.8 V <sub>CC</sub>    |                                 |                        | V    |
|                        |                                                                                          | V <sub>CC</sub> ≥ 2.7 V, I <sub>SOURCE</sub> = 0.5 mA                              | 0.8 V <sub>CC</sub>    |                                 |                        | V    |
|                        |                                                                                          | V <sub>CC</sub> ≥ 1.65 V, I <sub>SOURCE</sub> = 0.25 mA                            | 0.8 V <sub>CC</sub>    |                                 |                        | V    |
| t <sub>REC</sub>       | Reset timeout delay, factory-programmed                                                  | (device option)                                                                    | 240                    | 360                             | 480                    | ms   |
| R <sub>PUO</sub>       | Internal output pull-up resistor on RST                                                  | (device option)                                                                    |                        | 65                              |                        | kΩ   |
| I <sub>LO</sub>        | Output leakage current                                                                   | V <sub>RST</sub> = 5.5 V, open drain device option without output pull-up resistor | -0.1                   |                                 | 0.1                    | μA   |
| <b>Smart Reset™</b>    |                                                                                          |                                                                                    |                        |                                 |                        |      |
| t <sub>SRC</sub>       | Smart Reset™ delay                                                                       | T <sub>A</sub> = -40 to +85 °C                                                     | 0.8 × t <sub>SRC</sub> | t <sub>SRC</sub> <sup>(4)</sup> | 1.2 × t <sub>SRC</sub> | s    |
|                        |                                                                                          | T <sub>A</sub> = 25 °C                                                             | 0.9 × t <sub>SRC</sub> |                                 | 1.1 × t <sub>SRC</sub> |      |
| V <sub>IL</sub>        | $\overline{\text{SR0}}$ , $\overline{\text{SR1}}$ input voltage low                      |                                                                                    | V <sub>SS</sub> - 0.3  |                                 | 0.3                    | V    |
| V <sub>IH</sub>        | $\overline{\text{SR0}}$ , $\overline{\text{SR1}}$ input voltage high                     |                                                                                    | 0.85                   |                                 | 5.5                    | V    |
| I <sub>LI</sub>        | $\overline{\text{SR0}}$ , $\overline{\text{SR1}}$ input leakage current                  |                                                                                    | -0.1                   |                                 | 0.1                    | μA   |
|                        | Input glitch immunity <sup>(5)</sup>                                                     | $\overline{\text{SR0}}$ and $\overline{\text{SR1}}$ asserted                       |                        | t <sub>SRC</sub>                |                        | s    |
| <b>Test mode</b>       |                                                                                          |                                                                                    |                        |                                 |                        |      |
| V <sub>TEST</sub>      | Test mode entry voltage                                                                  |                                                                                    | V <sub>CC</sub> + 0.9  | V <sub>CC</sub> + 1.1           | V <sub>CC</sub> + 1.4  | V    |
| t <sub>SRC-INI</sub>   | Initial test mode time                                                                   |                                                                                    | 28                     | 42                              | 56                     | ms   |
| t <sub>SRC-SHORT</sub> | Shorten Smart Reset™ delay                                                               |                                                                                    | 16.8                   | 21                              | 25.2                   | ms   |

1. Valid for ambient operating temperature T<sub>A</sub> = -40 to +85 °C, V<sub>CC</sub> = 1.65 to 5.5 V.

2. Typical values are at 25 °C and V<sub>CC</sub> = 3.3 V unless otherwise noted.

3. Reset outputs are deasserted below 1.575 V typ. and remain deasserted down to V<sub>CC</sub> = 1 V.

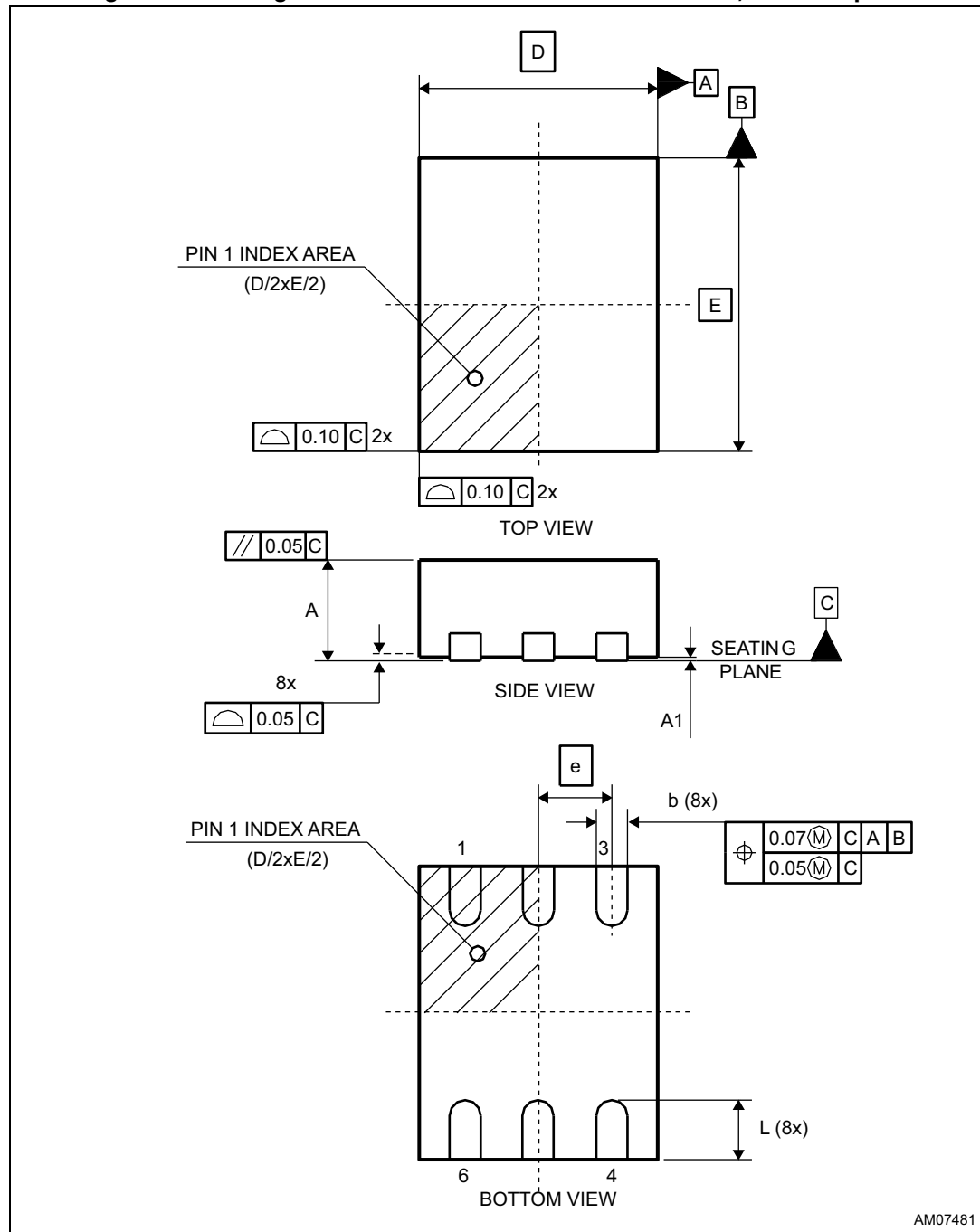
4. Factory-programmable in the range of 0.5 s to 10 s typ. in 0.5 s steps (see [Table 7](#) for available delays).

5. Input glitch immunity is equal to t<sub>SRC</sub>, when both inputs ( $\overline{\text{SR0}}$  and  $\overline{\text{SR1}}$ ) are low. Otherwise infinite.

## 8 Package information

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

**Figure 13. Package outline for UDFN6 1.6 x 1.3 x 0.55 mm, 0.40 mm pitch**





**Table 5. Mechanical data for UDFN6 1.6 x 1.3 x 0.55 mm, 0.40 mm pitch**

| Symbol | Dimensions            |       |       |                  |        |        | Note |
|--------|-----------------------|-------|-------|------------------|--------|--------|------|
|        | Drawing (millimeters) |       |       | Drawing (inches) |        |        |      |
|        | Min.                  | Typ.  | Max.  | Min.             | Typ.   | Max.   |      |
| A      | 0.50                  | 0.55  | 0.60  | 0.020            | 0.022  | 0.024  |      |
| A1     | 0.00                  | 0.02  | 0.05  | 0.0000           | 0.0008 | 0.0020 |      |
| b      | 0.15                  | 0.20  | 0.25  | 0.006            | 0.008  | 0.010  |      |
| D      | 1.30 BSC              |       |       | 0.051 BSC        |        |        |      |
| E      | 1.60 BSC              |       |       | 0.063 BSC        |        |        |      |
| e      | 0.40 BSC              |       |       | 0.016 BSC        |        |        |      |
| L      | 0.250                 | 0.325 | 0.400 | 0.0098           | 0.0128 | 0.0157 |      |
| N      | 6                     |       |       | 6                |        |        |      |

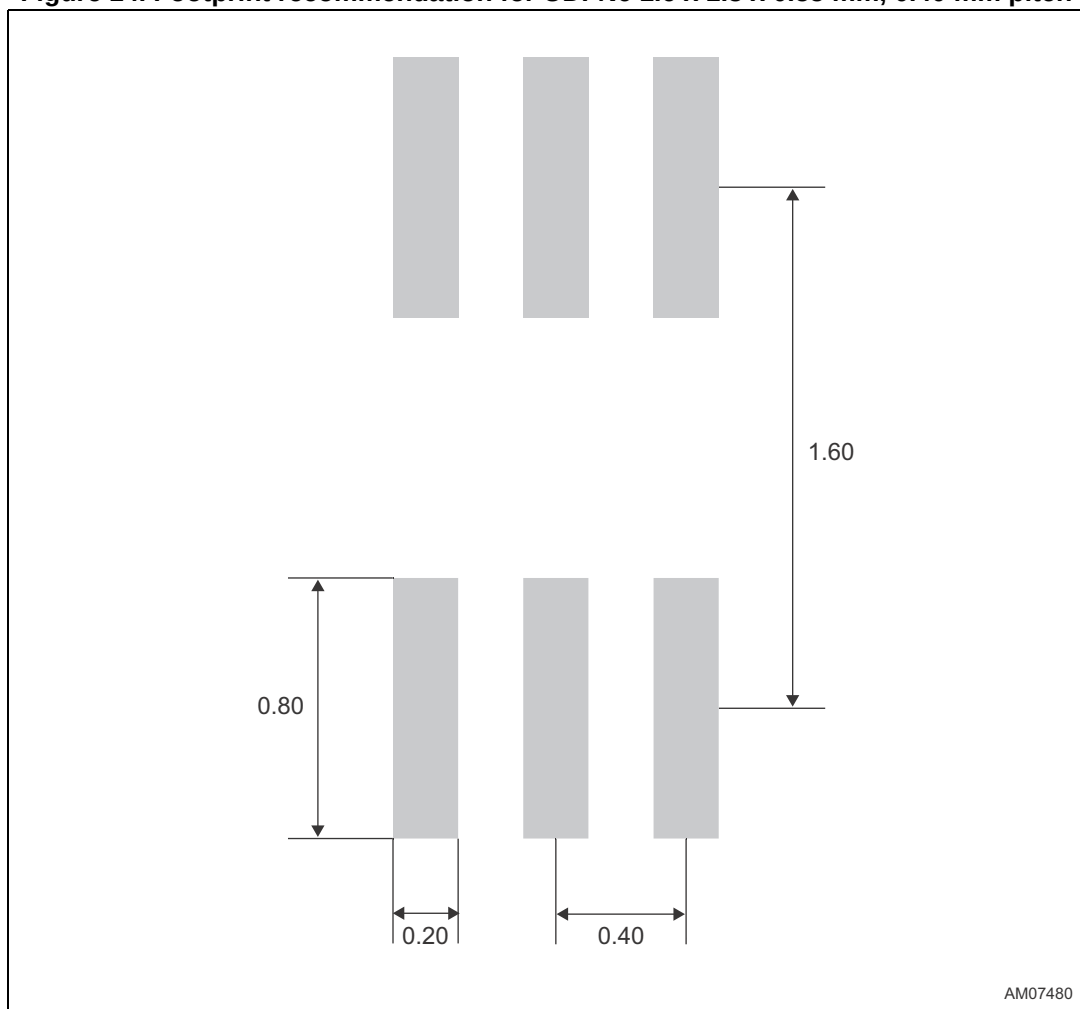
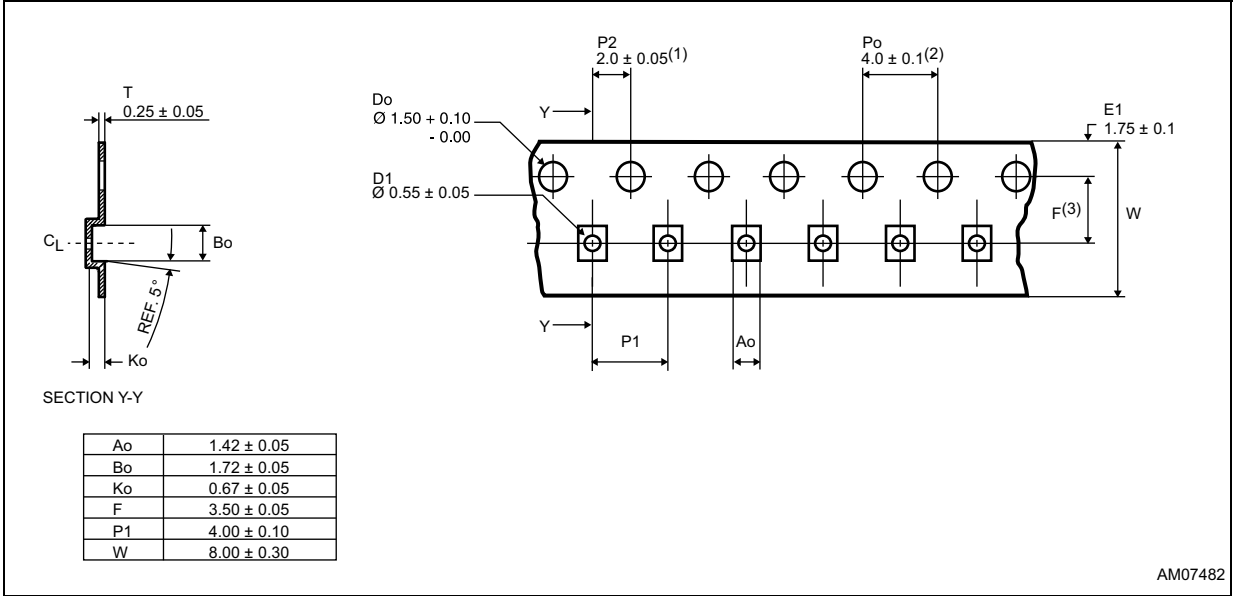
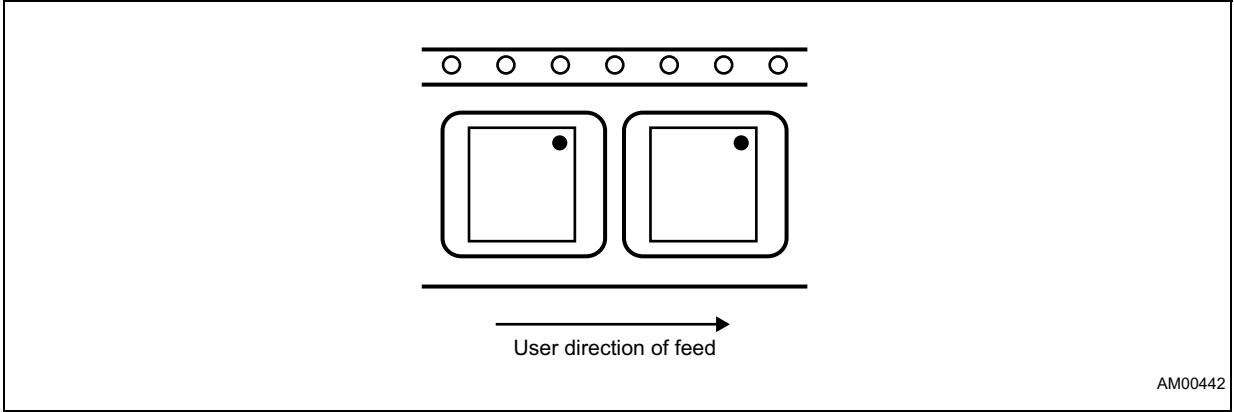
**Figure 14. Footprint recommendation for UDFN6 1.6 x 1.3 x 0.55 mm, 0.40 mm pitch**

Figure 15. Carrier tape for UDFN6 1.6 x 1.3 x 0.55 mm



1. Measured from centreline of sprocket hole to centreline of pocket.
2. Cumulative tolerance of 10 sprocket holes is  $\pm 0.20$ .
3. Measured from centreline of sprocket hole to centreline of pocket.
4. Other material available.
5. Typical SR of formed tape max.  $10^9 \Omega/\text{SQ}$ .
6. All dimensions in millimeters unless otherwise stated.

Figure 16. Pin 1 orientation



9 Part numbering

Table 6. Ordering information scheme

| Example:                                                                                                                                                                                                                                                          | SR2 | H | A | R | U |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---|---|---|---|
| Device type                                                                                                                                                                                                                                                       |     |   |   |   |   |
| SR2                                                                                                                                                                                                                                                               |     |   |   |   |   |
| Smart Reset™ set up delay (t <sub>SRC</sub> ) <sup>(1)</sup>                                                                                                                                                                                                      |     |   |   |   |   |
| H = factory programmable t <sub>SRC</sub> = 4.0 s, no pull-up<br>L = factory programmable t <sub>SRC</sub> = 6.0 s, no pull-up<br>P = factory programmable t <sub>SRC</sub> = 7.5 s, no pull-up<br>U = factory programmable t <sub>SRC</sub> = 10.0 s, no pull-up |     |   |   |   |   |
| Outputs type                                                                                                                                                                                                                                                      |     |   |   |   |   |
| A = open drain, no pull-up, active low                                                                                                                                                                                                                            |     |   |   |   |   |
| Reset timeout period (t <sub>REC</sub> )                                                                                                                                                                                                                          |     |   |   |   |   |
| B = factory programmable t <sub>REC</sub> = 360 ms (typ.)<br>R = push-button controlled                                                                                                                                                                           |     |   |   |   |   |
| Package                                                                                                                                                                                                                                                           |     |   |   |   |   |
| DL = UDFN6                                                                                                                                                                                                                                                        |     |   |   |   |   |

1. Smart Reset™ delay (t<sub>SRC</sub>) is available from 0.5 s to 10 s in 0.5 s steps (typ.). Minimum order quantities may apply. Contact local Sales office for availability.

## 10 Package marking information

Table 7. Package marking

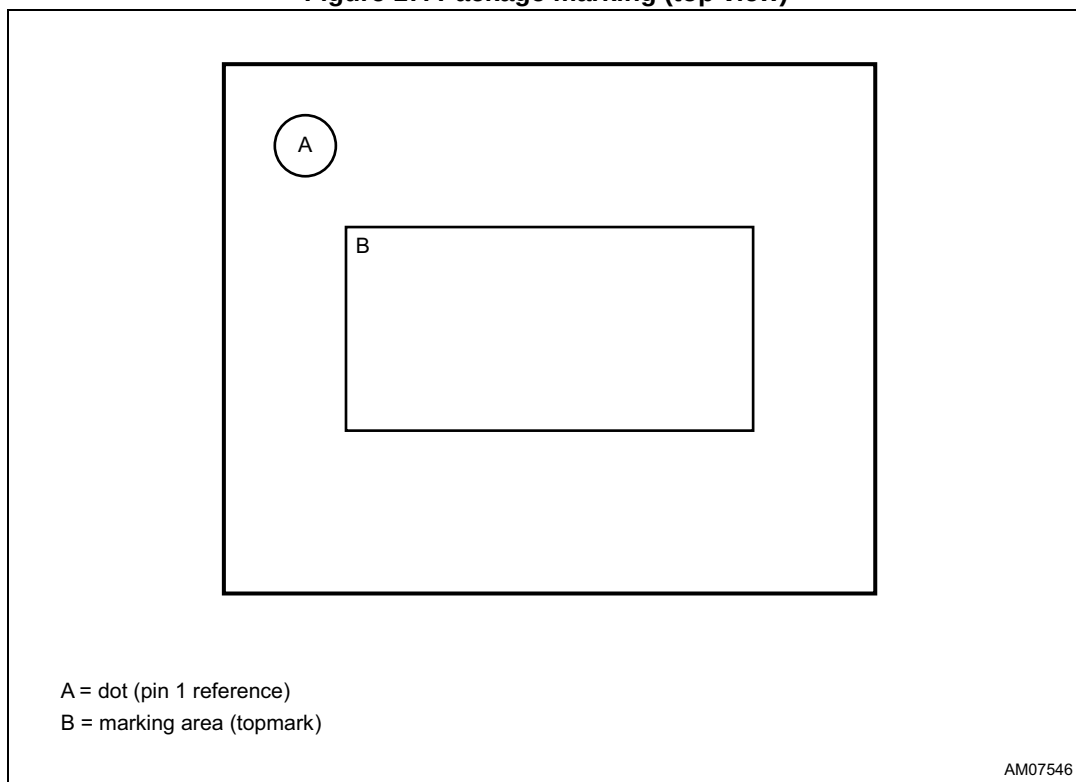
| Part number | $t_{\text{SRC}}$ (s) | Smart Reset™ inputs <sup>(1)</sup> | Output type <sup>(2)</sup> | $t_{\text{REC}}$ option (ms) <sup>(3)</sup> | Package | Topmark |
|-------------|----------------------|------------------------------------|----------------------------|---------------------------------------------|---------|---------|
| SR2HARU     | 4.0                  | AL                                 | OD, AL                     | No $t_{\text{REC}}$                         | UDFN6   | HA      |
| SR2LABU     | 6.0                  | AL                                 | OD, AL                     | 360                                         | UDFN6   | LC      |
| SR2LARU     | 6.0                  | AL                                 | OD, AL                     | No $t_{\text{REC}}$                         | UDFN6   | LA      |
| SR2PARU     | 7.5                  | AL                                 | OD, AL                     | No $t_{\text{REC}}$                         | UDFN6   | PA      |
| SR2UABU     | 10.0                 | AL                                 | OD, AL                     | 360                                         | UDFN6   | UC      |
| SR2UARU     | 10.0                 | AL                                 | OD, AL                     | No $t_{\text{REC}}$                         | UDFN6   | UA      |

1. AL = active low.

2. OD = open drain, AL = active low.

3. No  $t_{\text{REC}}$  = push-button controlled reset pulse width.

Figure 17. Package marking (top view)



## 11 Revision history

**Table 8. Document revision history**

| Date        | Revision | Changes                                                                                                      |
|-------------|----------|--------------------------------------------------------------------------------------------------------------|
| 10-Mar-2014 | 1        | Initial release                                                                                              |
| 13-May-2014 | 2        | Modified: $t_{REC}$ values <a href="#">Table 4 on page 15</a><br>Updated: <a href="#">Table 6 on page 19</a> |

**Please Read Carefully:**

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