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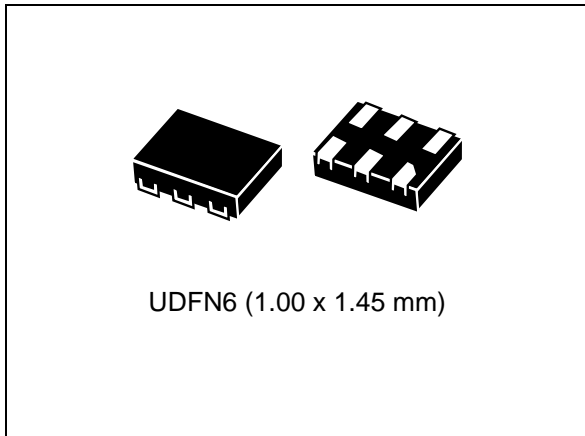
SR1PAAU

STMicroelectronics

Supervisory Circuits ANALOG

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info@kaimte.com



Applications

- Wearable
- Activity tracker
- Smartwatch
- Smartglasses

Features

- Operating voltage range 2 V to 5.5 V
- Low supply current 1 μ A
- Integrated test mode
- Single Smart Reset™ push-button input with fixed extended reset setup delay (t_{SRC}) from 0.5 s to 10 s in 0.5 s steps (typ.), option with internal input 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
- 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 1.00 mm x 1.45 mm
- ECOPACK®2 (RoHS compliant, Halogen-Free)

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1 Description

The Smart Reset™ devices provide a useful feature which ensures that inadvertent short reset push-button closures do not cause system resets. This is done by implementing an extended Smart Reset input delay time (t_{SRC}), which 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 is connected to the microcontroller interrupt input, and is 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 SR1 has one Smart Reset input (\overline{SR}) with preset delayed Smart Reset setup time (t_{SRC}). The reset output (\overline{RST}) is asserted after the Smart Reset input is held active for the selected t_{SRC} delay time. The \overline{RST} output remains asserted either until the \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 device fully operates over a broad V_{CC} range from 2.0 V to 5.5 V.

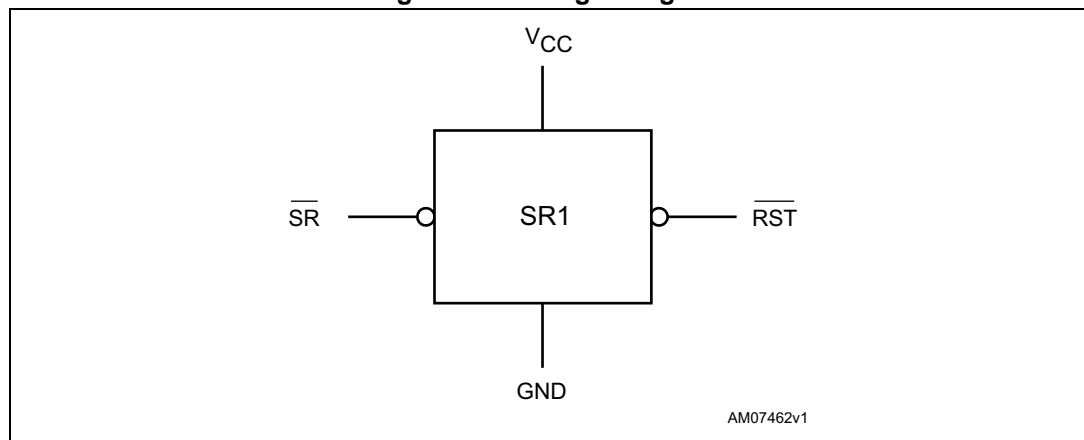
1.1 Test mode

After pulling \overline{SR} up to V_{TEST} ($V_{CC} + 1.4$ V) or above, the counter starts to count the initial shortened $t_{SRC-INI}$ (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{SR} is detected (if t_{REC} option is not used). This is feedback, and the user only knows that the device is locked in test mode. Each time the \overline{SR} input is connected to ground in test mode, a shortened $t_{SRC-SHORT}$ ($t_{SRC}/128$) is used instead of regular t_{SRC} (0.5 s - 10 s). In this way the device can be quickly tested without repeating test mode triggering. Return to normal mode is possible by performing a new startup of the device (i.e. V_{CC} goes to 0 V and back to its original state).

The advantages of this solution are its high glitch immunity, user feedback regarding entry into test mode, and testability within the full V_{CC} range.

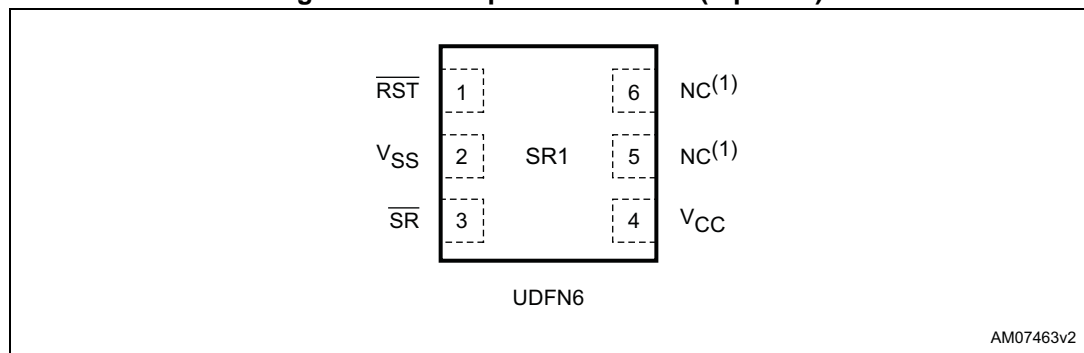
1.2 Logic diagram

Figure 1. SR1 logic diagram



1.3 Pin connections

Figure 2. UDFN6 pin connections (top view)



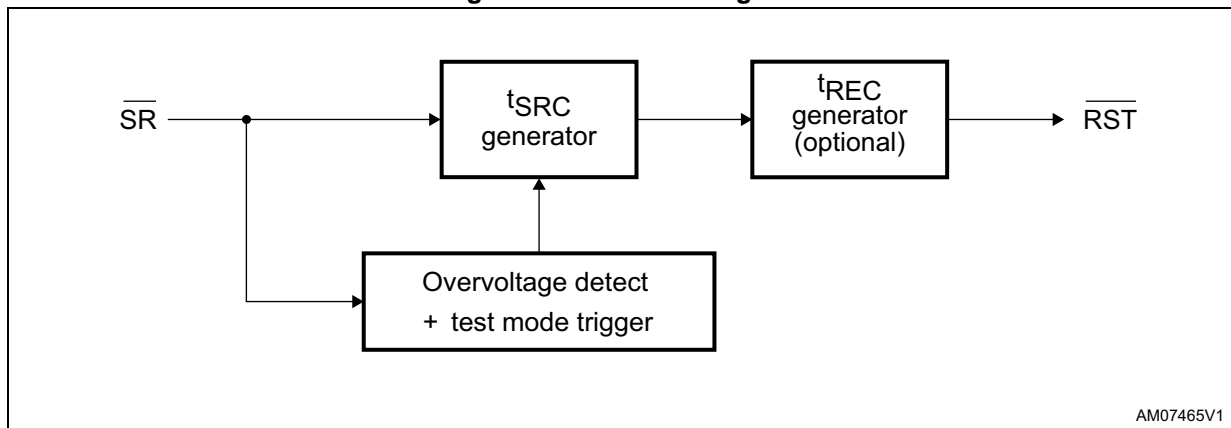
1. Not connected (not bonded); should be connected to V_{SS} .

2 Device overview

Table 1. Signal names

Pin n°	Name	Type	Description
1	$\overline{\text{RST}}$	Output	Reset output, active low, open drain.
2	V_{SS}	Supply ground	Ground
3	$\overline{\text{SR}}$	Input	Smart Reset input, active low.
4	V_{CC}	Supply voltage	Positive supply voltage for the device. A 0.1 μF decoupling ceramic capacitor is recommended to be connected between V_{CC} and V_{SS} pins.
5	NC	-	Not connected (not bonded); should be connected to V_{SS} .
6	NC	-	Not connected (not bonded); should be connected to V_{SS} .

Figure 3. SR1 block diagram



3 Pin descriptions

3.1 Power supply (V_{CC})

This pin is used to provide power to the Smart Reset device. A 0.1 μF ceramic decoupling capacitor is recommended to be connected between the V_{CC} and V_{SS} pins, as close to the SR1 device as possible.

3.2 Power-up sequence

In normal mode, if different input side ($\overline{\text{SR}}$) and V_{CC} voltage domains are used, power-on sequence must avoid meeting the test mode entry condition to avoid inadvertent test mode entry: there should not be logic high present on the $\overline{\text{SR}}$ input before the V_{CC} power-up. However V_{CC} and $V(\overline{\text{SR}})$ rising at the same time is OK (e.g. if both are in the same voltage domain), the device will then safely start into normal operating mode, with $\overline{\text{RST}}$ output inactive (in High-Z mode for open-drain option).

3.3 Ground (V_{SS})

This is the ground pin for the device.

3.4 Smart Reset input ($\overline{\text{SR}}$)

Push-button Smart Reset input, active low with optional pull-up resistor. $\overline{\text{SR}}$ input needs to be asserted for at least t_{SRC} to assert the reset output ($\overline{\text{RST}}$).

By connecting a voltage higher than $V_{CC} + 1.4 \text{ V}$ to the $\overline{\text{SR}}$ input the device enters test mode (see [Section 1: Description on page 3](#) for more information).

3.5 Reset output ($\overline{\text{RST}}$)

$\overline{\text{RST}}$ is active low or active high, open drain or push-pull 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 de-assert)
- Fixed, factory-programmed output reset pulse duration for t_{REC} independent on Smart Reset input state.

3.6 $\overline{\text{RST}}$ output undervoltage behavior (for open-drain option)

High-Z on $\overline{\text{RST}}$ output below the specified operating voltage range is guaranteed at V_{CC} power-on or in case that valid V_{CC} dropped while the device was idle, i.e. while both output and input were inactive.

4 Typical application diagrams

Figure 4. Typical application diagram - input, output and SR1 device in one voltage domain

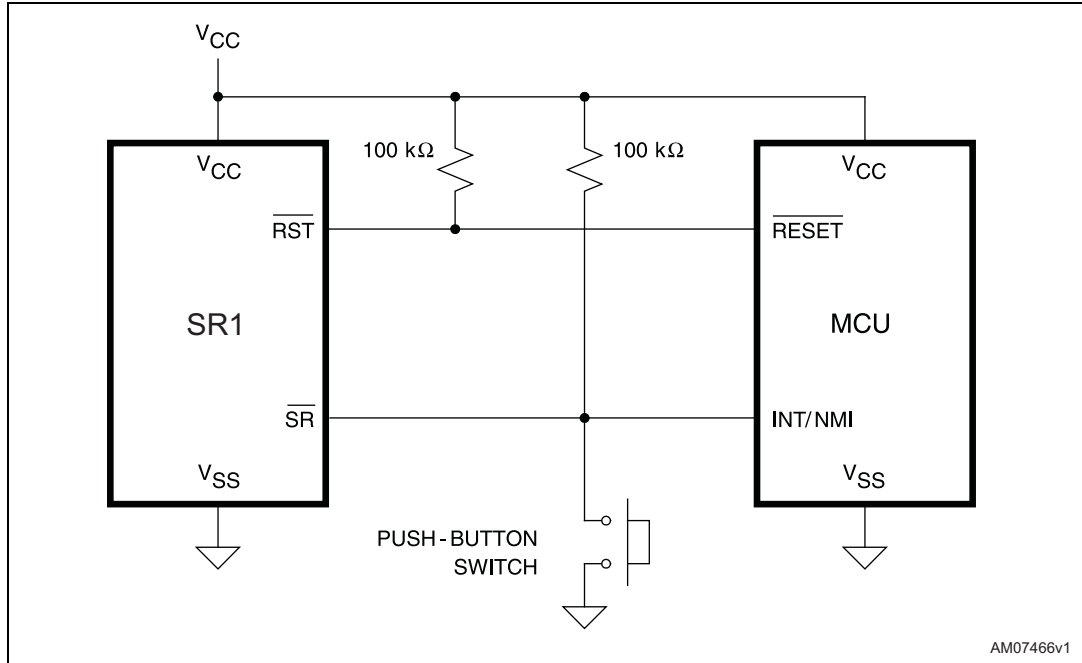
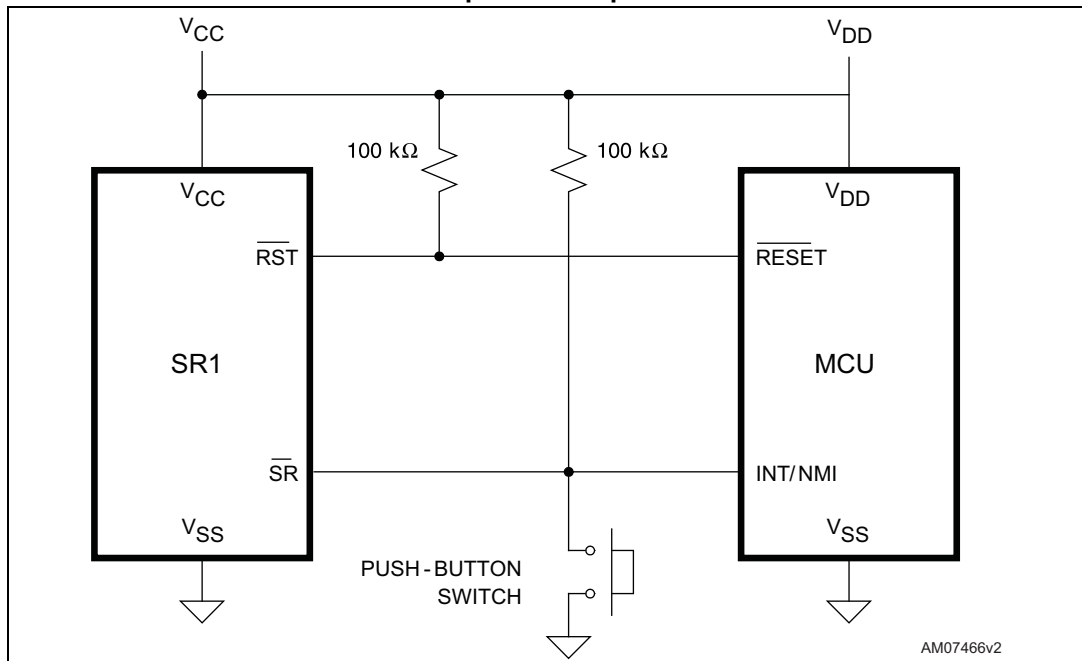
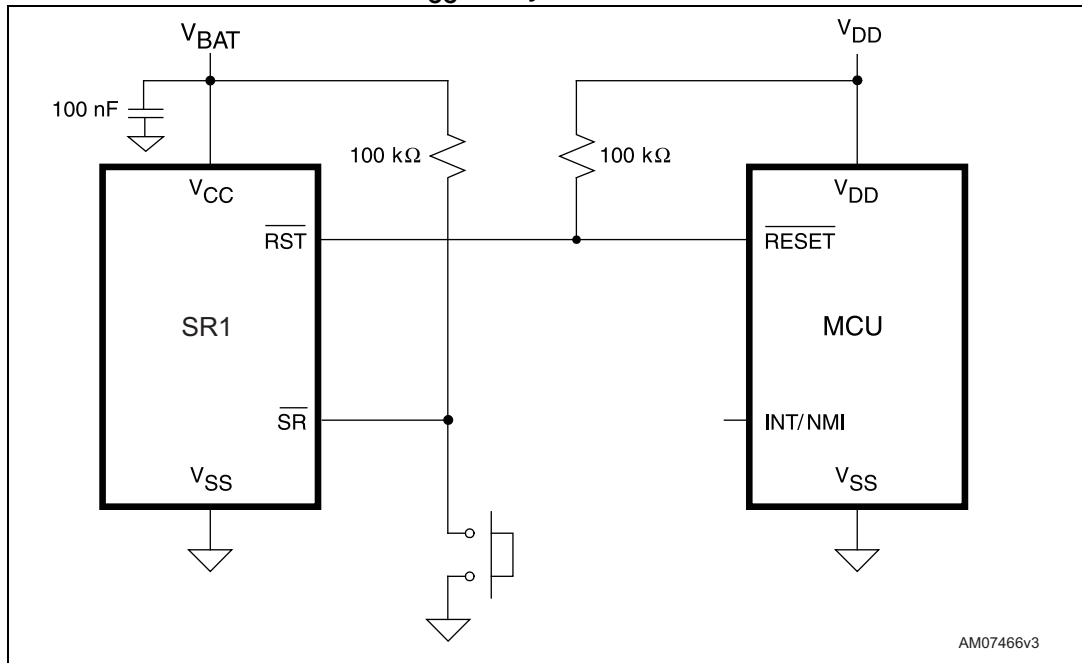


Figure 5. Typical application diagram - SR1 device in a different voltage domain than input and output



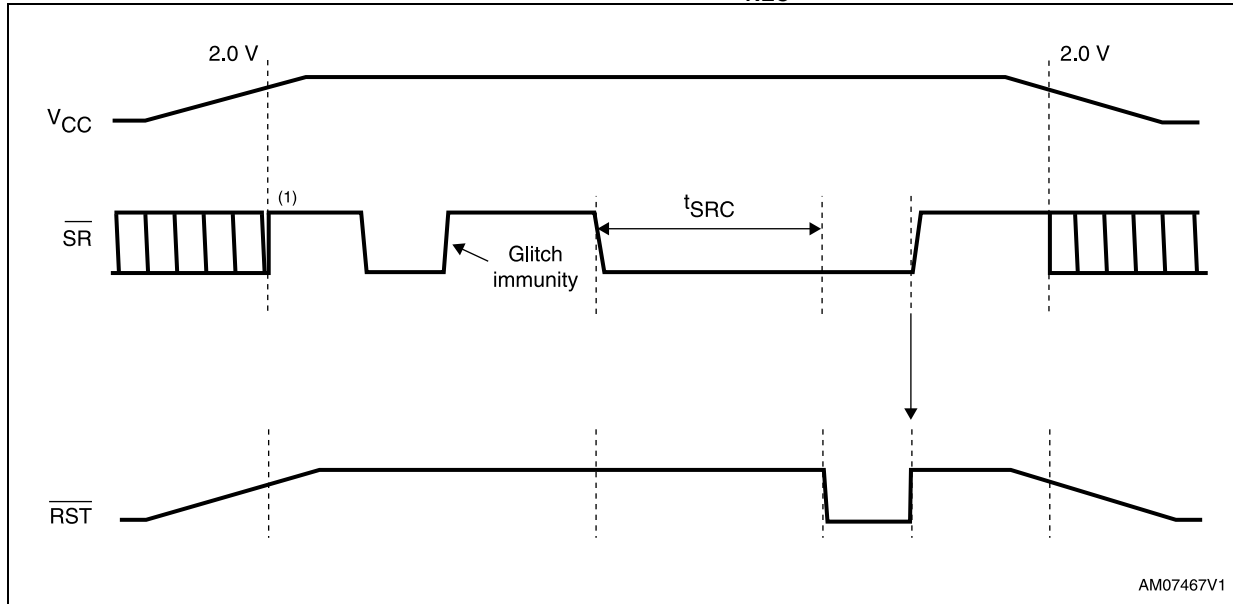
1. Open-drain $\overline{\text{RST}}$ output type and fixed $\overline{\text{SR}}$ input logic threshold allows to use the device in different voltage domains. To prevent entering test mode by creating a condition $V(\overline{\text{SR}}) > V_{\text{CC}} + 1.1 \text{ V typ.}$, V_{CC} should be powered up before or together with voltage on the $\overline{\text{SR}}$ input.

Figure 6. Typical application diagram in different voltage domains - \overline{SR} input in V_{BAT} domain like V_{CC} totally disables the test mode



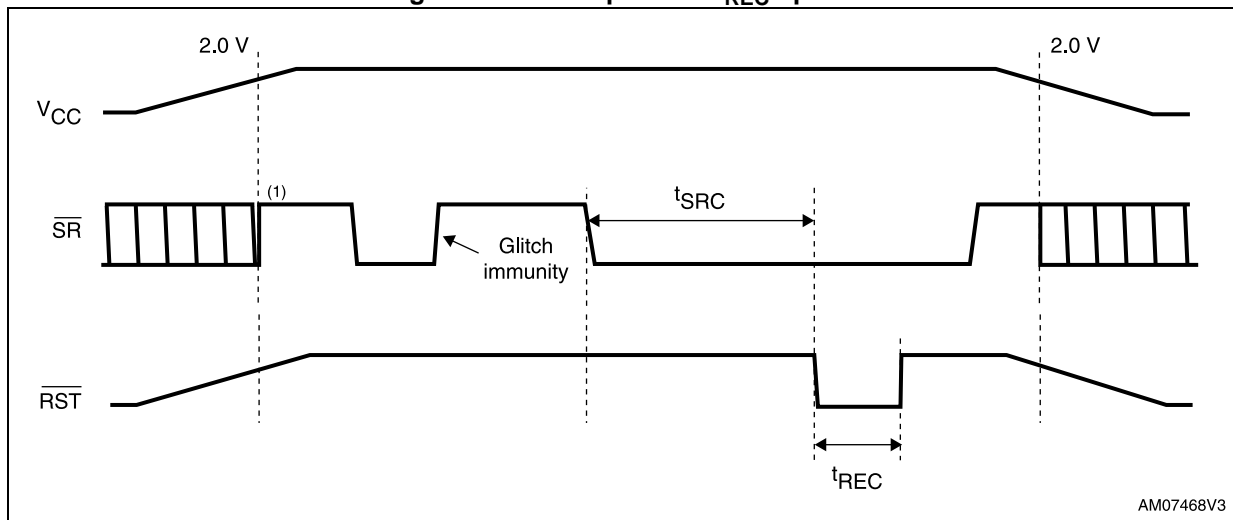
5 Timing diagrams

Figure 7. $\overline{\text{RST}}$ output without t_{REC} option



1. V_{CC} should be powered up before or together with voltage on the $\overline{\text{SR}}$ input to prevent entering test mode by creating a condition $V(\overline{\text{SR}}) > V_{\text{CC}} + 1.1 \text{ V typ.}$

Figure 8. $\overline{\text{RST}}$ output with t_{REC} option



1. V_{CC} should be powered up before or together with voltage on the $\overline{\text{SR}}$ input to prevent entering test mode by creating a condition $V(\overline{\text{SR}}) > V_{\text{CC}} + 1.1 \text{ V typ.}$

6 Typical operating characteristics

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

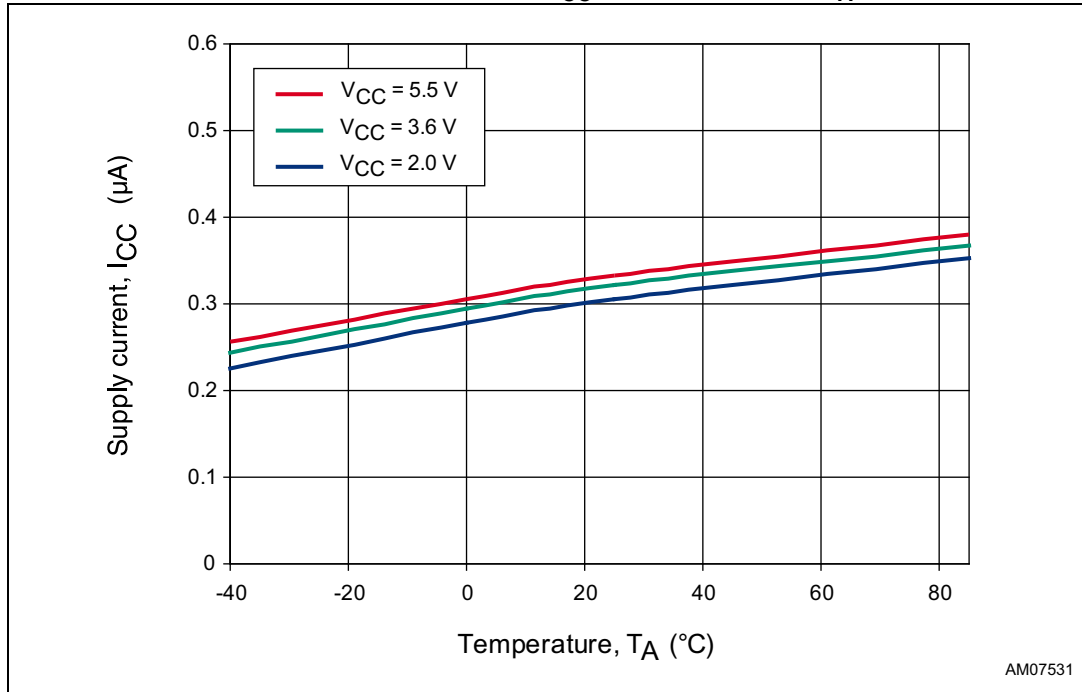


Figure 10. Smart Reset delay (t_{SRC}) vs. temperature (T_A), $t_{SRC} = 4.0 s$ (typ.)

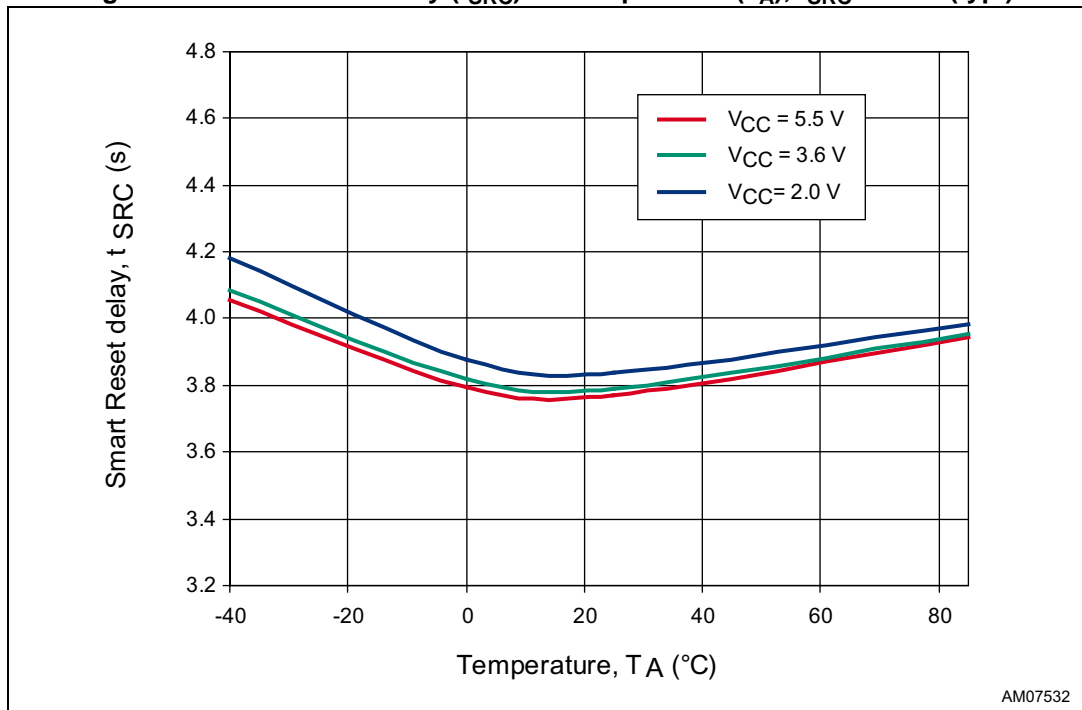


Figure 11. Test mode entry voltage (V_{TEST}) vs. temperature (T_A)

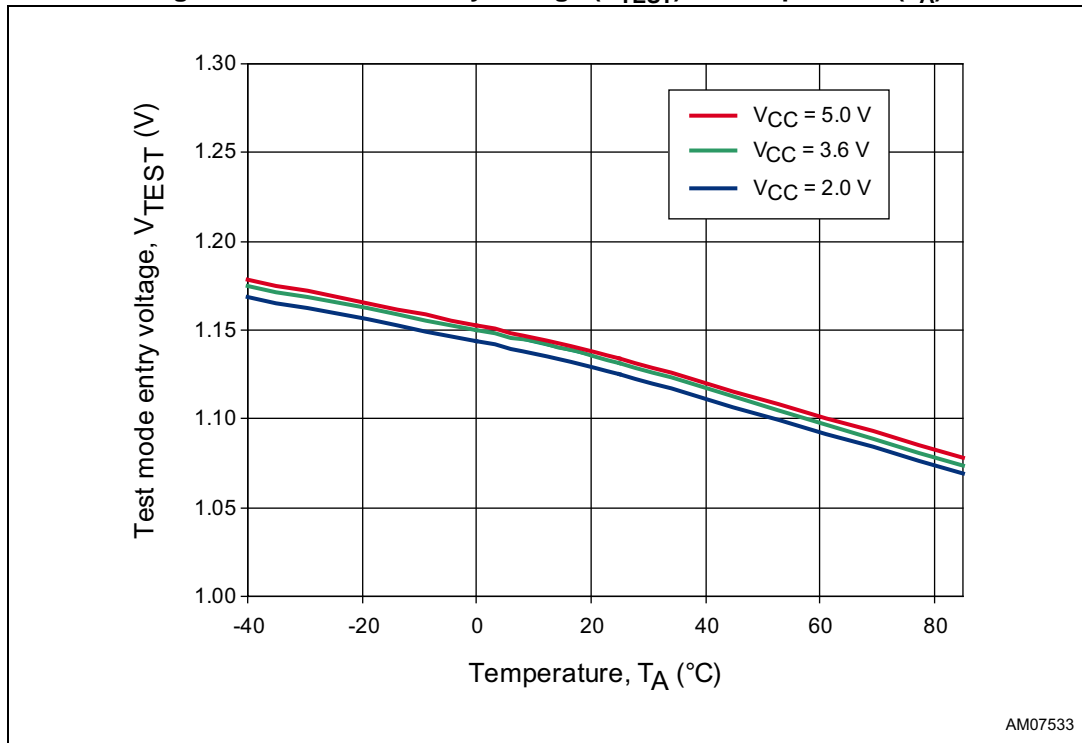
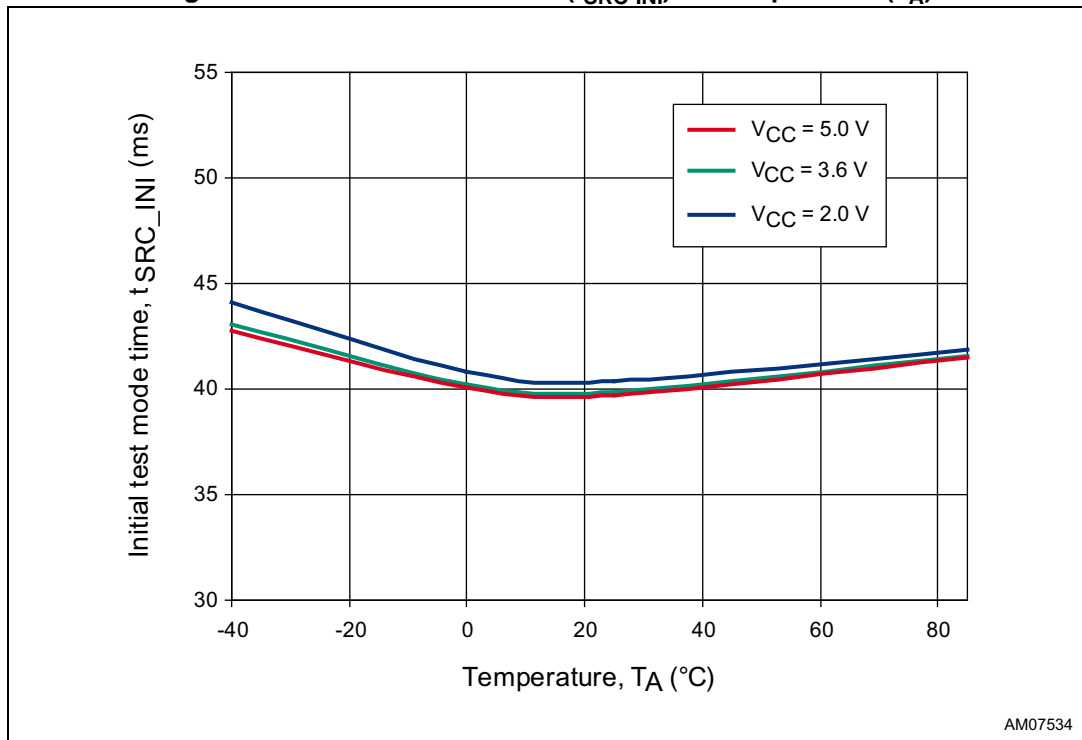


Figure 12. Initial test mode time (t_{SRC_INI}) vs. temperature (T_A)



7 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_{STG}	Storage temperature (V_{CC} off)	-55 to +150	°C
$T_{SLD}^{(1)}$	Lead solder temperature for 10 seconds	260	°C
V_{IO}	Input or output voltage	-0.3 to 5.5	V
V_{CC}	Supply voltage	-0.3 to 7	V
ESD			
V_{HBM}	Electrostatic discharge protection, human body model (JESD22-A114-B level 2)	2	kV
V_{RCDM}	Electrostatic discharge protection, charged device model, all pins	1	kV
V_{MM}	Electrostatic discharge protection, machine model, all pins (JESD22-A115-A level A)	200	V
	Latch-up (V_{CC} pin, \overline{SR} reset input pin)	EIA/JESD78	

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

8 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 characteristics](#) 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	2.0 to 5.5	V
T_A	Ambient operating temperature	-40 to +85	°C
t_R, t_F	Input rise and fall times	≤ 5	ns
	Input pulse voltages	0.2 to 0.8 V_{CC}	V
	Input and output timing reference voltages	0.3 to 0.7 V_{CC}	V

Table 4. DC and AC characteristics

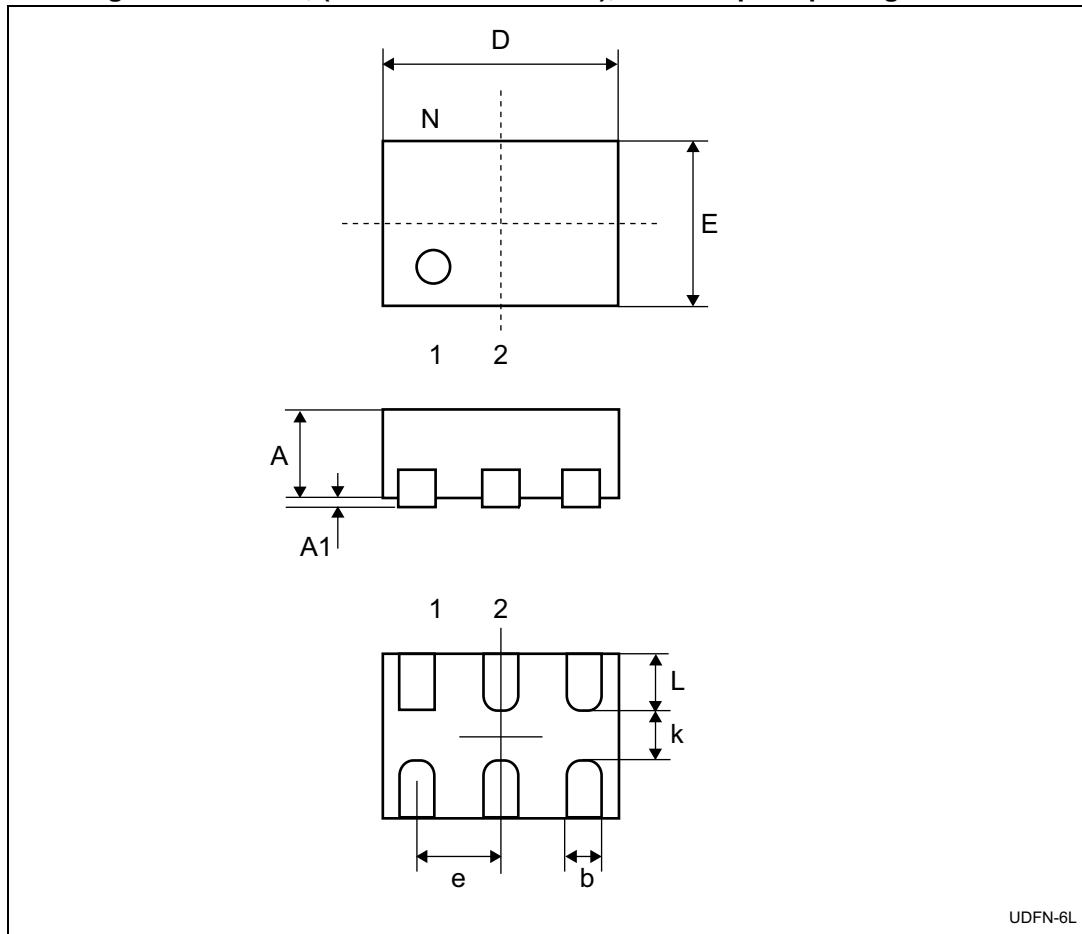
Symbol	Parameter	Test conditions ⁽¹⁾	Min.	Typ. ⁽²⁾	Max.	Unit
V _{CC}	Supply voltage		2.0		5.5	V
I _{CC}	Supply current	$\overline{SR} = V_{CC}$, t _{REC} and t _{SRC} counter is not running		0.4	1.0	μA
V _{OL}	Reset output voltage low	V _{CC} ≥ 4.5 V, sinking 3.2 mA			0.3	V
		V _{CC} ≥ 3.3 V, sinking 2.5 mA			0.3	V
		V _{CC} ≥ 2.0 V, sinking 1 mA			0.3	V
t _{REC}	Reset timeout delay, factory-programmed	(device option)	140	210	280	ms
			240	360	480	ms
R _{PUO}	Internal output pull-up resistor on RST	(device option)		65		kΩ
I _{LO}	Output leakage current	V _{RST} = 5.5 V, open drain device option without output pull-up resistor	-0.1		0.1	μA
Smart Reset						
t _{SRC}	Smart Reset delay	T _A = -40 to +85 °C	0.8 x t _{SRC}	t _{SRC} ⁽³⁾	1.2 x t _{SRC}	s
		T _A = 25 °C	0.9 x t _{SRC}		1.1 x t _{SRC}	
V _{IL}	\overline{SR} input voltage low		V _{SS} -0.3		0.3	V
V _{IH}	\overline{SR} input voltage high		0.85		5.5	V
R _{PUI}	Internal input pull-up resistor on SR	(device option)		65		kΩ
I _{LEAK}	\overline{SR} input leakage current	device option without input pull-up resistor	-0.1		0.1	μA
	Input glitch immunity			t _{SRC}		s
Test mode						
V _{TEST}	Test mode entry voltage		V _{CC} +0.9	V _{CC} +1.1	V _{CC} +1.4	V
t _{SRC-INI}	Initial test mode time		28	42	56	ms
t _{SRC-SHORT}	Shortened Smart Reset delay			t _{SRC} / 128		ms

1. Valid for ambient operating temperature T_A = -40 to +85 °C, V_{CC} = 2.0 to 5.5 V.
2. Typical values are at 25 °C and V_{CC} = 3.3 V unless otherwise noted.
3. Factory-programmable in the range of 0.5 s to 10 s typ. in 0.5 s steps.

9 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. ECOPACK is an ST trademark.

Figure 13. UDFN6, (1.00 x 1.45 x 0.50 mm), 0.50 mm pitch package outline



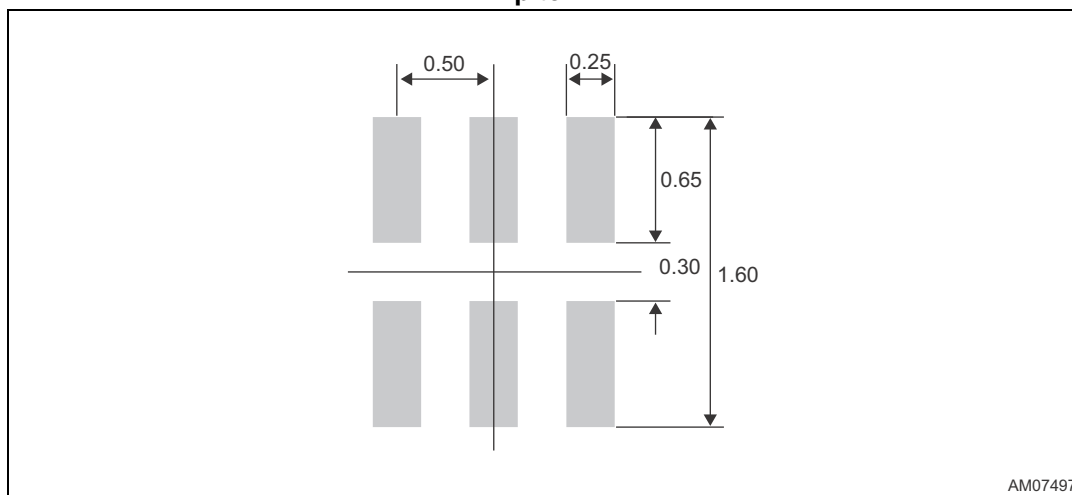
UDFN-6L

Table 5. UDFN6, (1.00 x 1.45 x 0.50 mm), 0.50 mm pitch package mechanical data

Symbol	Dimensions						Note ⁽¹⁾
	(mm)			(inches)			
	Min.	Typ.	Max.	Min.	Typ.	Max.	
A	0.50	0.55	0.60	0.0197	0.0217	0.0236	
A1	0.00	0.02	0.05	0.000	0.0008	0.0020	
b	0.18	0.25	0.30	0.0071	0.0098	0.0118	
D	1.40	1.45	1.50	0.0551	0.0571	0.0591	
E	0.95	1.00	1.05	0.0374	0.0394	0.0413	
e	0.45	0.50	0.55	0.0177	0.0197	0.0217	
k	0.20			0.0079			
L	0.30	0.35	0.40	0.0118	0.0138	0.0157	

1. Package outline exclusive of any mold flashes dimensions and metal burrs.

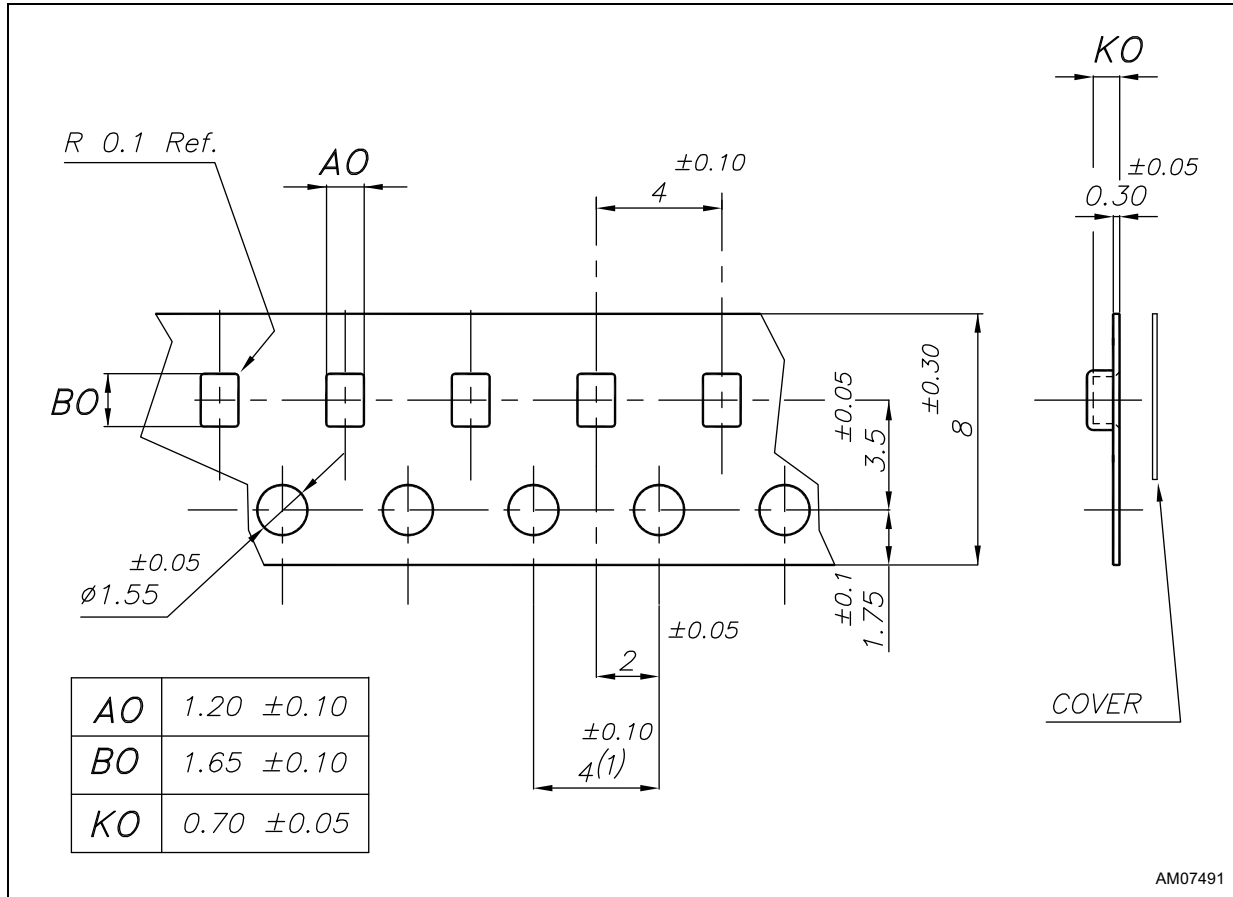
Figure 14. Footprint recommendation for UDFN6 (1.00 x 1.45 x 0.50 mm), 0.50 mm pitch



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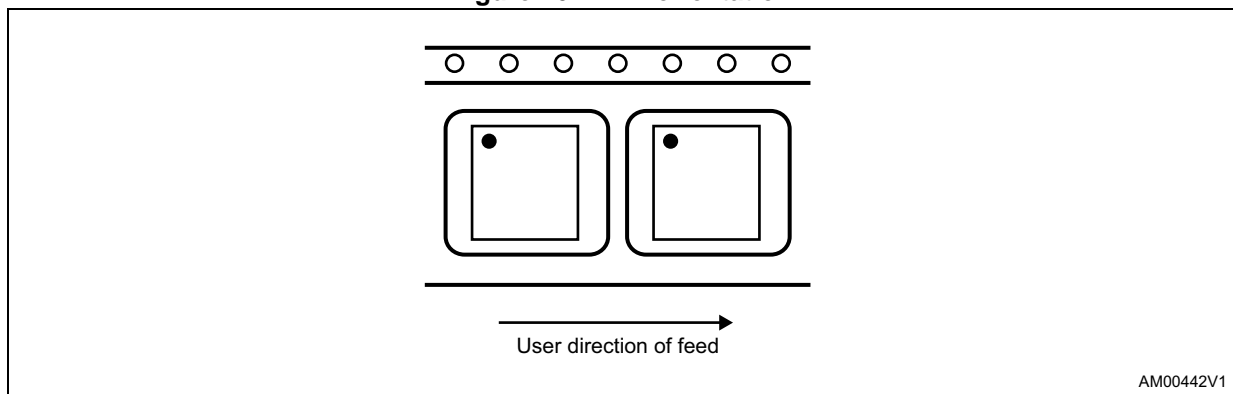
10 Tape and reel information

Figure 15. Carrier tape



1. 10-sprocket hole pitch cumulative tolerance ±0.20.

Figure 16. Pin 1 orientation



11 Part numbering

Table 6. Ordering information scheme

Example:	SR1	H	A	R	U
Device type					
SR1					
Smart Reset setup delay (t_{SRC})⁽¹⁾					
C = factory programmable $t_{SRC} = 1.5$ s (typ.)					
H = factory programmable $t_{SRC} = 4.0$ s (typ.)					
L = factory programmable $t_{SRC} = 6.0$ s (typ.)					
P = factory programmable $t_{SRC} = 7.5$ s (typ.)					
U = factory programmable $t_{SRC} = 10.0$ s (typ.)					
Inputs, outputs type⁽²⁾					
A = active low \overline{SR} input with no pull-up, active low open drain \overline{RST} output with no pull-up					
B = active low \overline{SR} input with pull-up, active low open drain \overline{RST} output with no pull-up					
Reset timeout period (t_{REC})					
A = factory programmable $t_{REC} = 210$ ms (typ.)					
B = factory programmable $t_{REC} = 360$ ms (typ.)					
R = push-button controlled (no defined t_{REC})					
Package					
U = UDFN-6L					

1. Smart Reset delay (t_{SRC}) 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.
2. Push-pull reset output type also available (active low or active high). \overline{SR} input and open drain reset output available with optional pull-up resistor. Minimum order quantities may apply. Contact local sales office for availability.

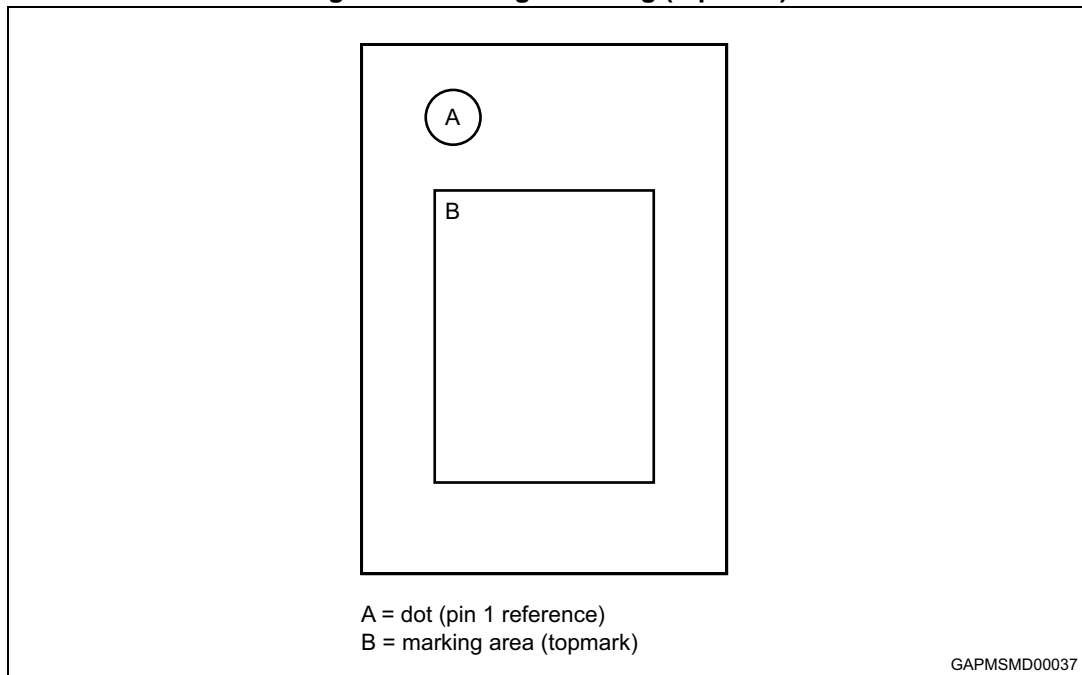
12 Package marking information

Table 7. Package marking

Part number	t_{SRC} (s)	Smart Reset inputs ⁽¹⁾	Output type ⁽²⁾	t_{REC} option ⁽³⁾	Package	Topmark
SR1CARU	1.5	AL	OD, AL	No t_{REC}	UDFN6	CA
SR1HARU	4.0	AL	OD, AL	No t_{REC}	UDFN6	HA
SR1LARU	6.0	AL	OD, AL	No t_{REC}	UDFN6	LA
SR1PAAU	7.5	AL	OD, AL	210 ms	UDFN6	PB
SR1PARU	7.5	AL	OD, AL	No t_{REC}	UDFN6	PA
SR1PBBU	7.5	AL + pull-up	OD, AL	360 ms	UDFN6	PC
SR1UARU	10.0	AL	OD, AL	No t_{REC}	UDFN6	UA

1. AL = active low.
2. OD = open drain, AL = active low.
3. No t_{REC} = push-button controlled reset pulse width, any other value represents typical value of t_{REC} .

Figure 17. Package marking (top view)



13 Revision history

Table 8. Document revision history

Date	Revision	Changes
10-Mar-2014	1	Initial release
13-May-2014	2	Modified t_{REC} values Table 4 on page 14

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