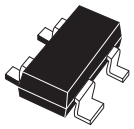
STM6315

Open drain microprocessor reset

Features

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



SOT143-4 (W1)

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1 Summary description

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

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

Figure 1. Logic diagram

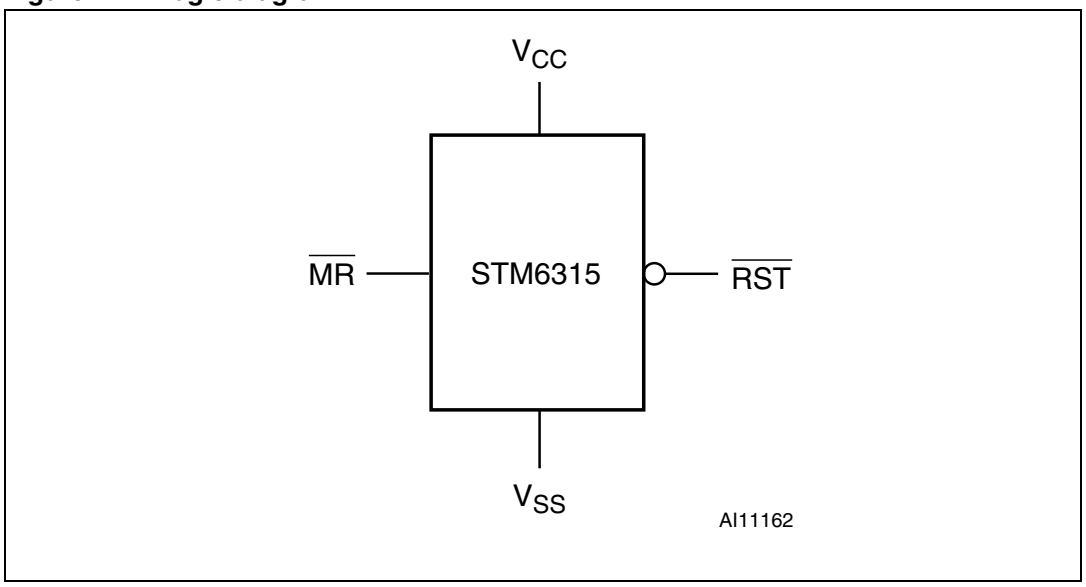


Table 1. Signal names

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

Figure 2. SOT143-4 connections (top view)

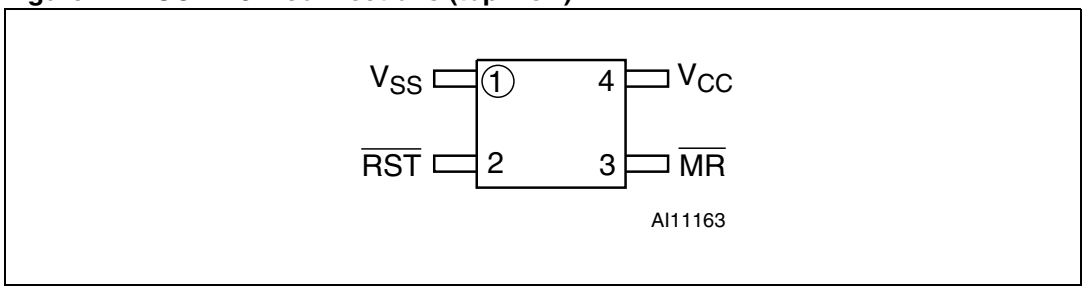


Figure 3. Block diagram

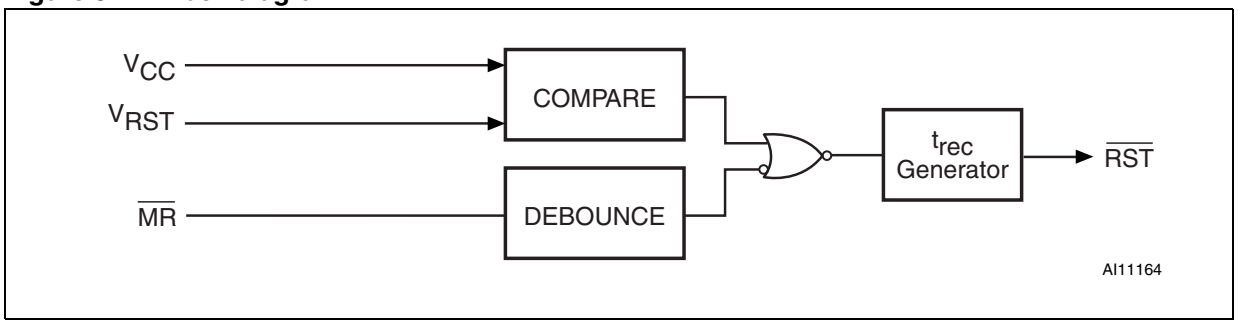
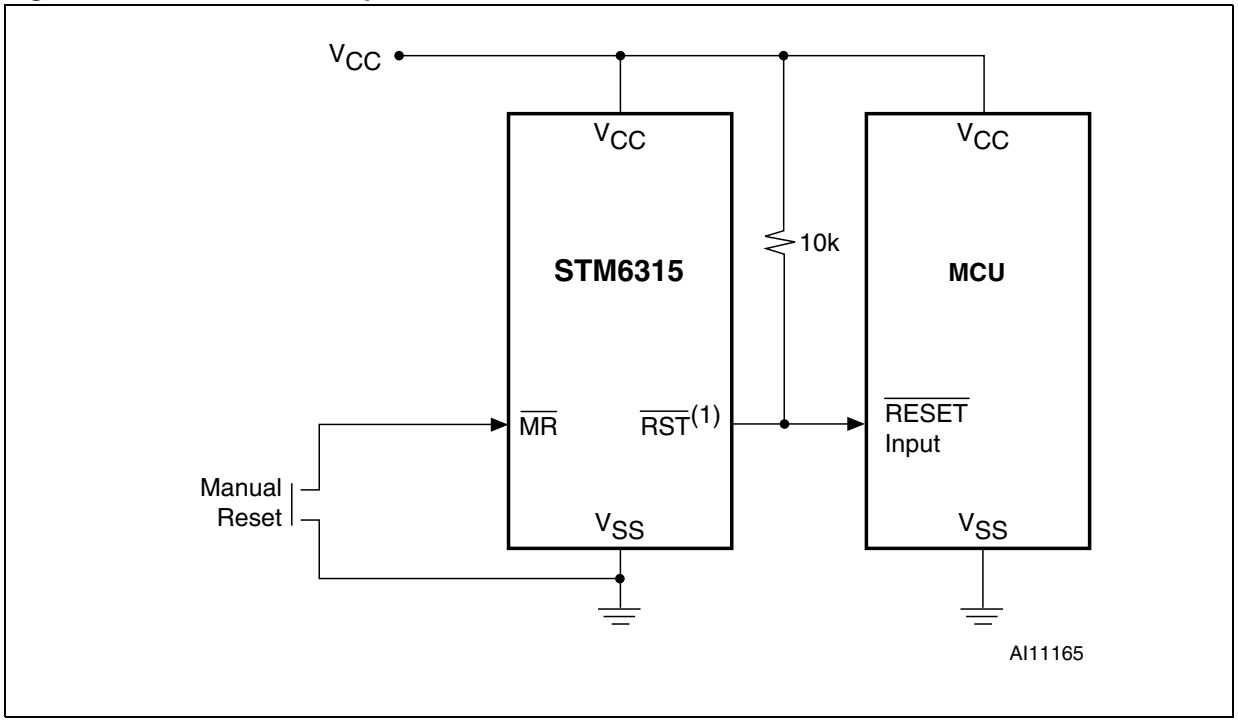


Figure 4. Hardware hookup



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

2 Operation

2.1 Reset output

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

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

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

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

2.2 Manual reset input

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

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

2.3 Negative-going V_{CC} transients

The STM6315 is relatively immune to negative-going V_{CC} transients (glitches). *Figure 12 on page 11* shows typical transient duration versus reset comparator overdrive (for which the STM6315 will NOT generate a reset pulse). The graph was generated using a negative pulse applied to V_{CC}, starting at 0.5V above the actual reset threshold and ending below it by the magnitude indicated (Reset Threshold Overdrive). The graph indicates the maximum pulse width a negative V_{CC} transient can have without causing a reset pulse. As the magnitude of the transient increases (further below the threshold), the maximum allowable pulse width decreases. Any combination of duration and overdrive which lies under the curve will NOT generate a reset signal (see *Figure 12*). A 0.1µF bypass capacitor mounted as close as possible to the V_{CC} pin provides additional transient immunity.

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

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

Figure 5. Reset timing diagram

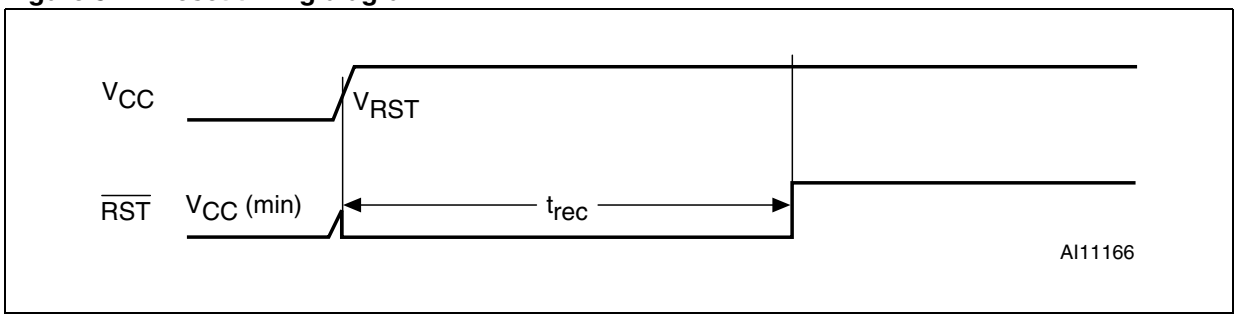
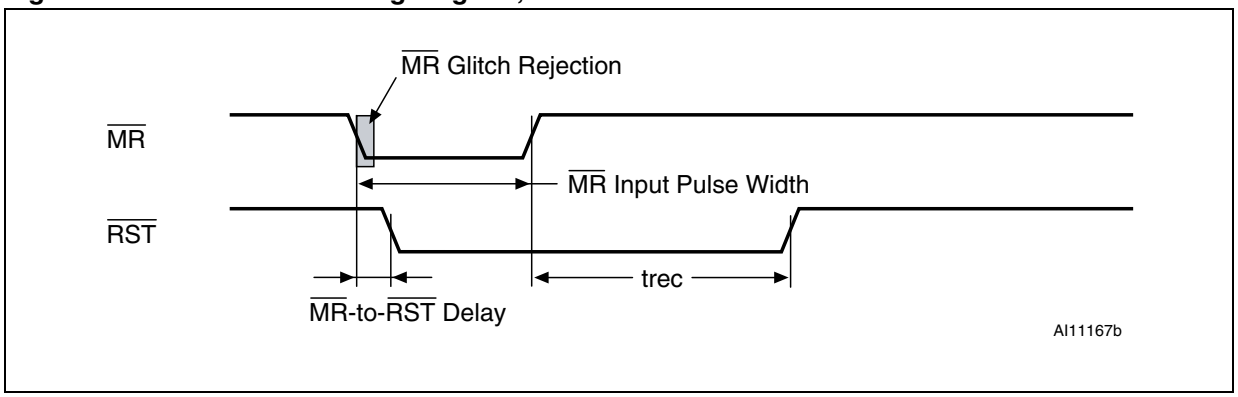


Figure 6. Manual reset timing diagram, switch bounce/debounce



3 Typical operating characteristics

Note: Typical values are at T_A = 25°C.

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

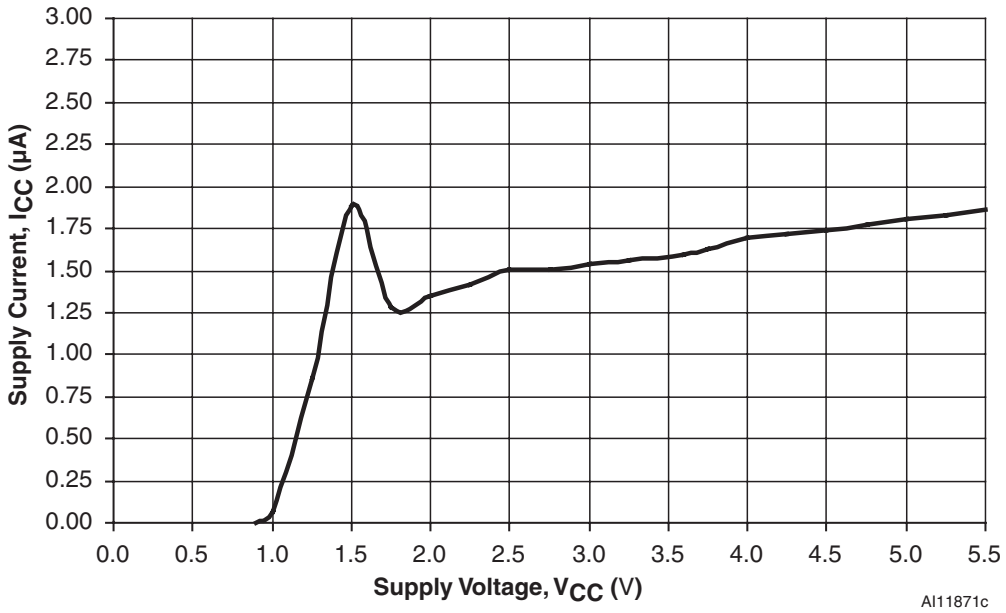


Figure 8. Supply current vs. temperature (no load), V_{RST} = 2.63V

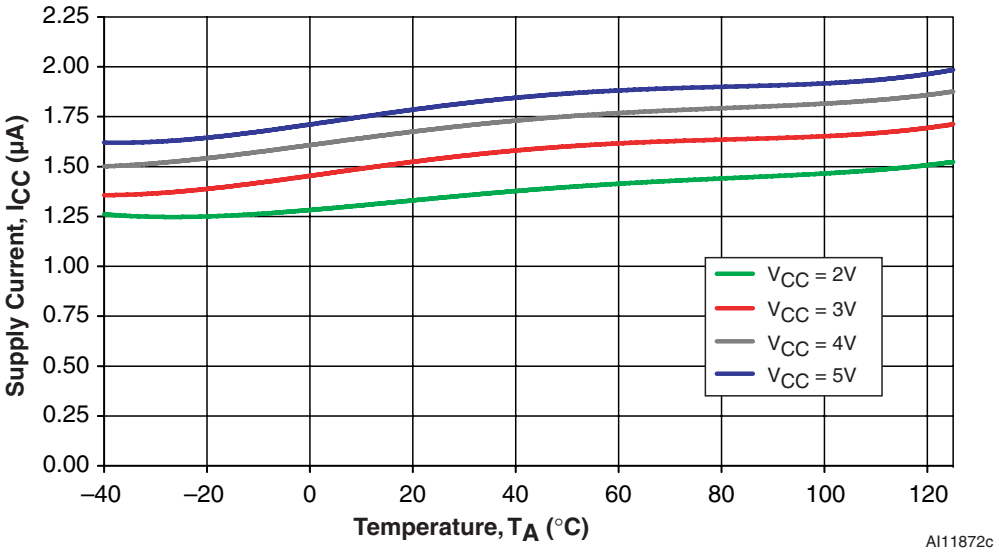


Figure 9. $\overline{RST}$ output voltage vs. output current, V_{CC} = 4.25V

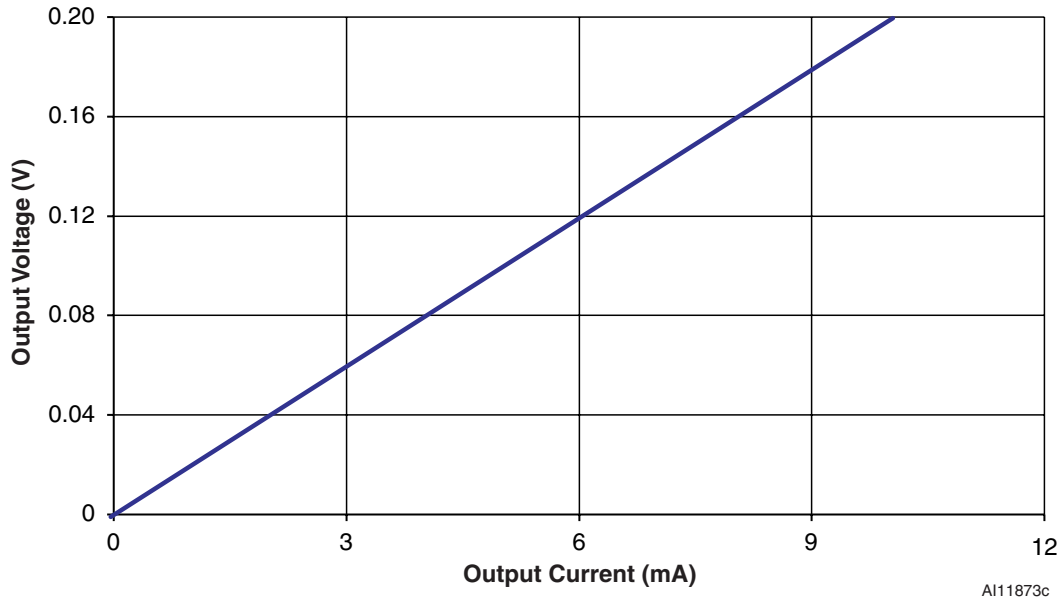


Figure 10. Normalized reset time-out period vs. temperature

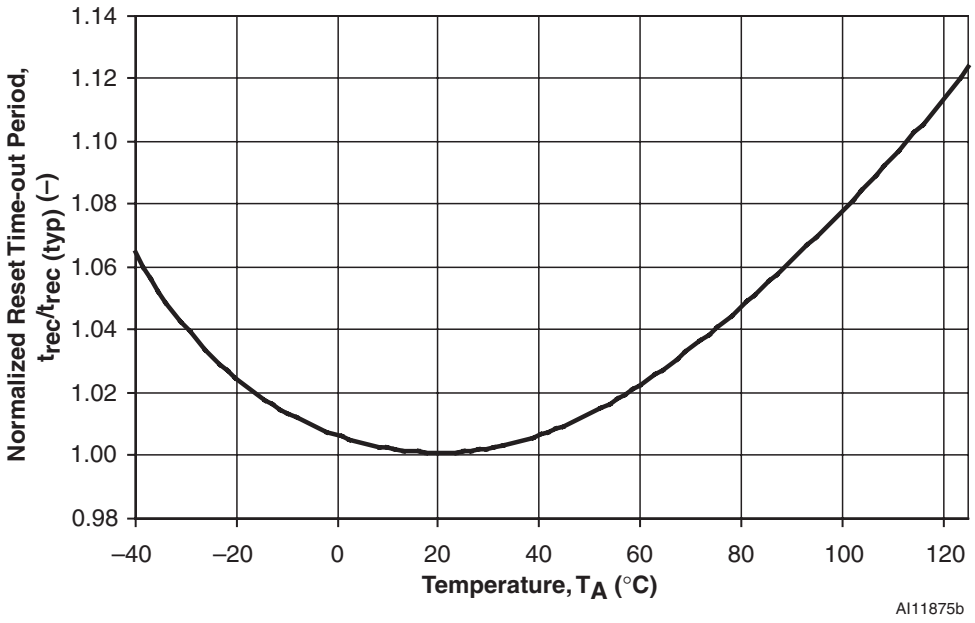


Figure 11. Normalized reset threshold vs. temperature

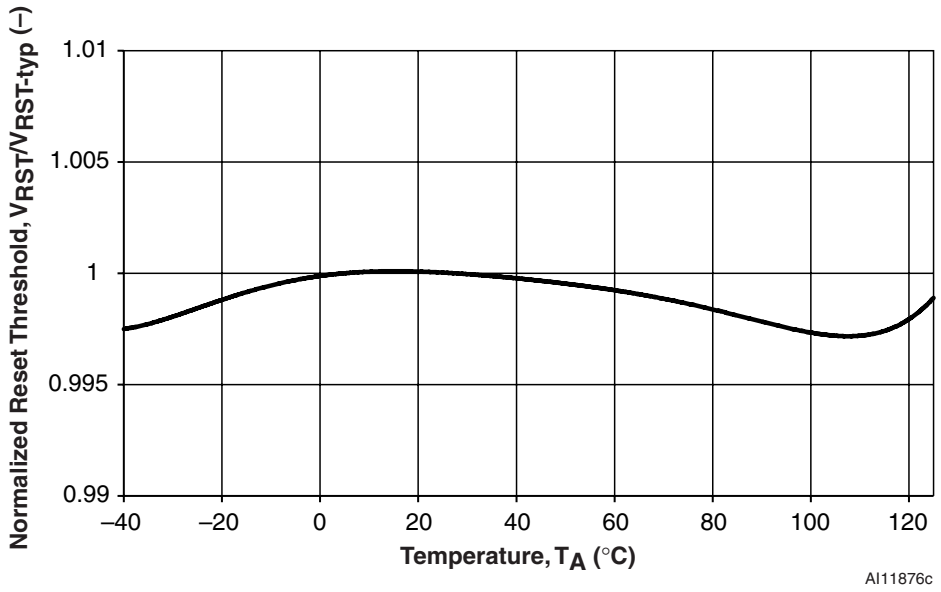
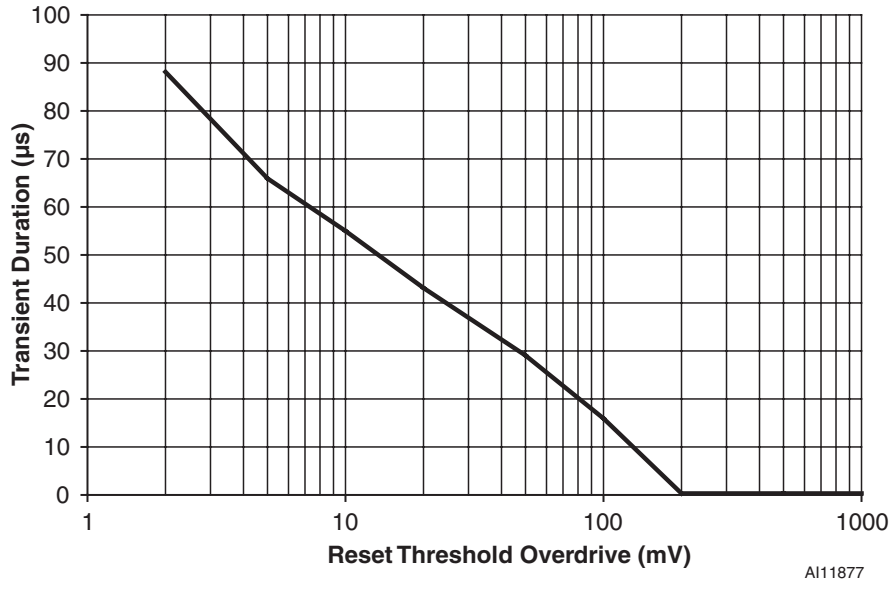


Figure 12. Max. transient duration not causing reset pulse vs. reset threshold Overdrive



Note: Reset occurs above the curve.

4 Maximum rating

Stressing the device above the rating listed in the *Table 2: Absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those indicated in the Operating sections of this specification is not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability. Refer also to the STMicroelectronics SURE Program and other relevant quality documents.

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
T_{STG}	Storage temperature (V_{CC} Off)	–55 to 150	°C
T_{SLD}(1)	Lead solder temperature for 10 seconds	260	°C
V_{IO}	Input or output voltage	–0.3 to V_{CC} + 0.3	V
V_{CC}	Supply voltage	–0.3 to 7.0	V
I_O	Output current	20	mA
P_D	Power dissipation	320	mW

1. Reflow at peak temperature of 260°C (total thermal budget not to exceed 245°C for greater than 30 seconds).

5 DC and AC parameters

This section summarizes the operating measurement conditions, and the DC and AC characteristics of the device. The parameters in the DC and AC characteristics Tables that follow are derived from tests performed under the measurement conditions summarized in *Table 3: Operating and AC measurement conditions*. Designers should check that the operating conditions in their circuit match the operating conditions when relying on the quoted parameters.

Table 3. Operating and AC measurement conditions

Parameter	STM6315	Unit
V_{CC} Supply Voltage	1.0 to 5.5	V
Ambient Operating Temperature (T_A)	–40 to +125	°C
Input Rise and Fall Times	~5	ns
Input Pulse Voltages	0.2 to 0.8V_{CC}	V
Input and Output Timing Reference Voltages	0.3 to 0.7V_{CC}	V

Figure 13. AC testing input/output waveforms

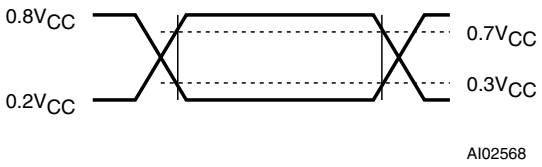


Table 4. DC and AC characteristics

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

Table 4. DC and AC characteristics (continued)

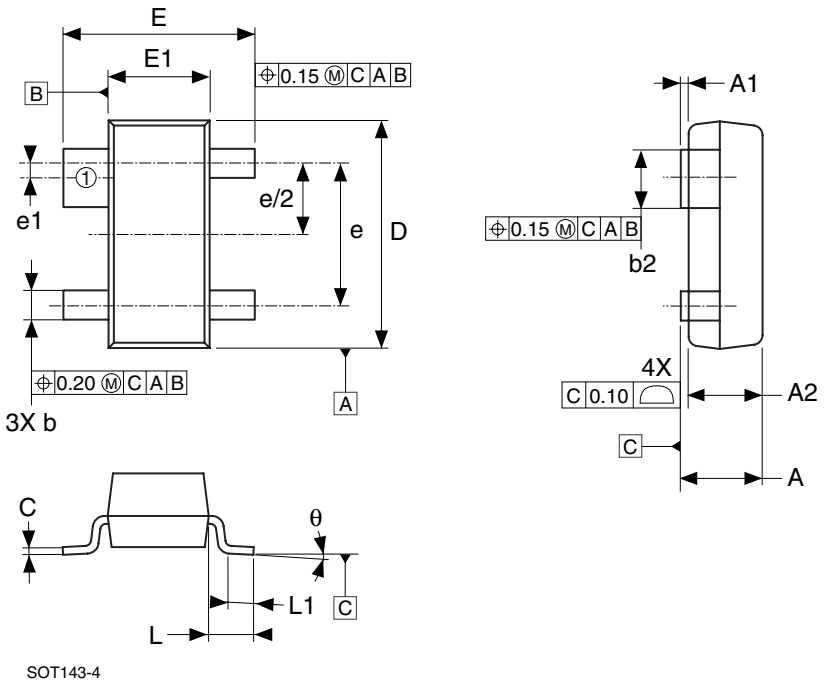
Sym	Description	Test Condition (1)	Min	Typ	Max	Unit
Manual Reset Input						
V_{IL}	$\overline{MR}$ low input threshold	V_{RST} > 4.0V	0.8			V
		V_{RST} < 4.0V	$0.3V_{CC}$			V
V_{IH}	$\overline{MR}$ low input threshold	V_{RST} > 4.0V			2.4	V
		V_{RST} < 4.0V			$0.7V_{CC}$	V
	$\overline{MR}$ input pulse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

1. Valid for ambient operating temperature: T_A = –40 to 125°C; V_{CC} = 2.5 to 5.5V (except where noted).
2. Other V_{RST} thresholds and t_{rec} timings are offered. Minimum order quantities may apply. Contact local sales office for availability.

6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

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



Note: Drawing is not to scale.

Table 5. SOT143-4 – 4-lead small outline transistor package mechanical data

Symbol	mm			inches		
	Typ	Min	Max	Typ	Min	Max
A	–	0.89	1.12	–	0.035	0.044
A1	–	0.01	0.10	–	0.001	0.004
A2	–	0.88	1.02	–	0.035	0.042
b	–	0.37	0.51	–	0.015	0.020
b2	–	0.76	0.94	–	0.030	0.037
C	–	0.09	0.18	–	0.004	0.007
D	–	2.80	3.04	–	0.110	0.120
E	–	2.10	2.64	–	0.083	0.104
E1	–	1.20	1.40	–	0.047	0.055
e	1.92	–	–	0.076	–	–
e1	0.20	–	–	0.008	–	–
L	0.55	–	–	0.022	–	–
L1	–	0.40	0.60	–	0.016	0.024
Θ		0°	10°		0°	10°
N	4			4		

7 Part numbering

Table 6. Ordering information scheme

Example: STM6315 R D W1 3 F

Device Type

STM6315

Reset Threshold Voltage (1)

L = V_{RST} = 4.63V

M = V_{RST} = 4.38V

S = V_{RST} = 2.93V

R = V_{RST} = 2.63V

$\overline{RST}$ Pulse Width (1)

A = t_{rec} = 1.5ms

B = t_{rec} = 30ms

D = t_{rec} = 210ms

G = t_{rec} = 1680ms

Package

W1 = SOT143-4

Temperature Range

3 = –40 to 125°C

Shipping Method

F = ECOPACK Package, Tape & Reel

1. Other V_{RST} thresholds and t_{rec} timings are offered. Minimum order quantities may apply. Contact local sales office for availability.

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

Table 7. Marking description

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

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

8 Revision history

Table 8. Document revision history

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

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