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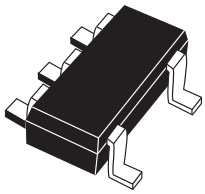
STM632x, STM682x

5-pin supervisor with watchdog timer and push-button reset

Datasheet - production data



SOT23-5 (WY)

Features

- Precision V_{CC} monitoring of 5, 3.3, 3, or 2.5 V power supplies
- $\overline{RST}$ outputs (active low, push-pull or open drain)
- RST outputs (active high, push-pull)
- Reset pulse width of 1.4 ms, 200 ms and 240 ms (typ.)
- Watchdog timeout period of 1.6 s (typ.)
- Manual reset input ($\overline{MR}$)
- Low supply current - 3 µA (typ.)
- Guaranteed $\overline{RST}$ (RST) assertion down to V_{CC} = 1.0 V
- Operating temperature: –40 to +85 °C (industrial grade)
- RoHS compliance
  Lead-free components are compliant with the RoHS directive

Table 1. Device summary

Part number		Watchdog input	Manual reset input	Reset output		
				Active low (push-pull)	Active high (push-pull)	Active low (open drain)
STM632x	STM6321	✔			✔	✔
	STM6322		✔		✔	✔
STM682x	STM6821	✔	✔		✔	
	STM6822	✔	✔			✔
	STM6823	✔	✔	✔		
	STM6824	✔		✔	✔	
	STM6825		✔	✔	✔	

Contents

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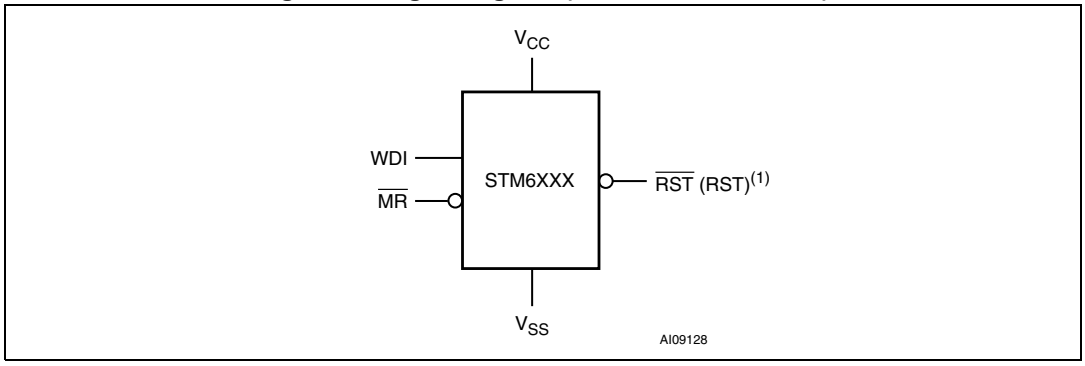
1 Description

The STM6xxx supervisors are self-contained devices which provide microprocessor supervisory functions. A precision voltage reference and comparator monitors the V_{CC} input for an out-of-tolerance condition. When an invalid V_{CC} condition occurs, the reset output ($\overline{RST}$) is forced low (or high in the case of RST). These devices also offer a watchdog timer (except for STM6322/6825) and/or a push-button ($\overline{MR}$) reset input.

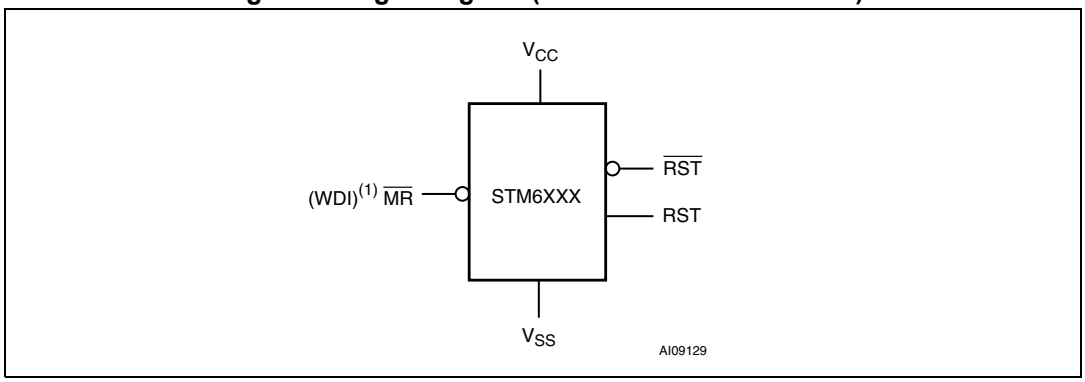
These devices are available in a standard 5-pin SOT23 package.

Figure 1. Logic diagram (STM6821/6822/6823)



1. For STM6821 only.

Figure 2. Logic diagram (STM6321/6322/6824/6825)

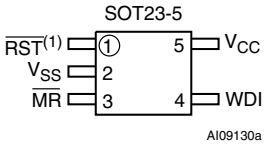


1. For STM6321/6824.

Table 2. Signal names

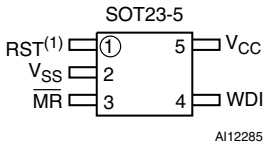
Name	Function
$\overline{MR}$	Push-button reset input
WDI	Watchdog input
$\overline{RST}$	Active low reset output
RST	Active high reset output
V_{CC}	Supply voltage
V_{SS}	Ground

Figure 3. STM6822/6823 SOT23-5 connections



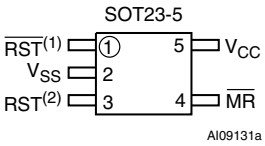
1. Open drain for STM6822.

Figure 4. STM6821 SOT23-5 connections



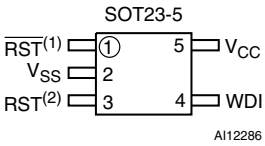
1. Push-pull only.

Figure 5. STM6322/6825 SOT23-5 connections



1. Open drain for STM6322.
2. Push-pull only.

Figure 6. STM6321/6824 SOT23-5 connections



1. Open drain for STM6321.
2. Push-pull only.

1.1 Pin description

1.1.1 Active low, push-pull reset output ($\overline{RST}$) - 6823/6824/6825

Pulses low when triggered, and stays low whenever V_{CC} is below the reset threshold or when $\overline{MR}$ is a logic low. It remains low for t_{rec} after either V_{CC} rises above the reset threshold, the watchdog triggers a reset, or $\overline{MR}$ goes from low to high.

1.1.2 Active low, open drain reset output ($\overline{RST}$) - STM6321/6322/6822

Pulses low when triggered, and stays low whenever V_{CC} is below the reset threshold or when $\overline{MR}$ is a logic low. It remains low for t_{rec} after either V_{CC} rises above the reset threshold, the watchdog triggers a reset, or $\overline{MR}$ goes from low to high. Connect a pull-up resistor to supply voltage.

1.1.3 Push-button reset input ($\overline{MR}$)

A logic low on $\overline{MR}$ asserts the reset output. Reset remains asserted as long as $\overline{MR}$ is low and for t_{rec} after $\overline{MR}$ returns high. This active low input has an internal 52 kΩ pull-up. It can be driven from a TTL or CMOS logic line, or shorted to ground with a switch. Leave open if unused.

1.1.4 Watchdog input (WDI)

If WDI remains high or low for at least 1.6 s, the internal watchdog timer expires and reset is asserted. The internal watchdog timer clears while reset is asserted or when WDI sees a rising or falling edge. The watchdog function **CAN** be disabled if WDI is left unconnected or is connected to a tristate buffer output.

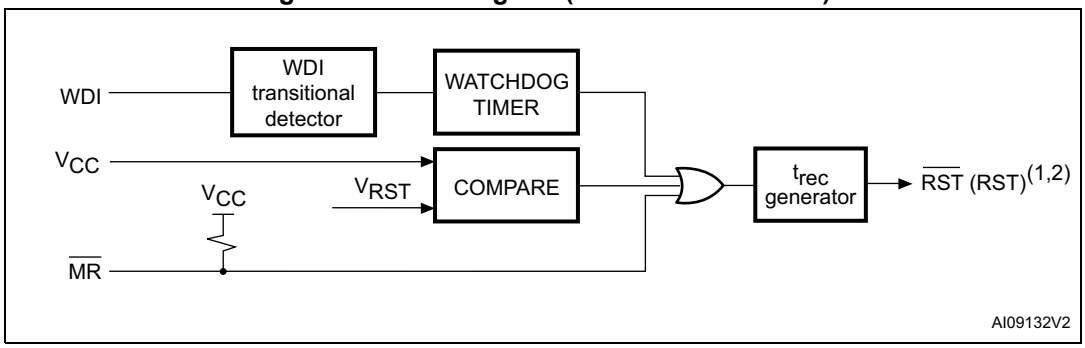
1.1.5 Active high reset output (RST)

Active high, push-pull reset output; inverse of $\overline{RST}$.

Table 3. Pin function

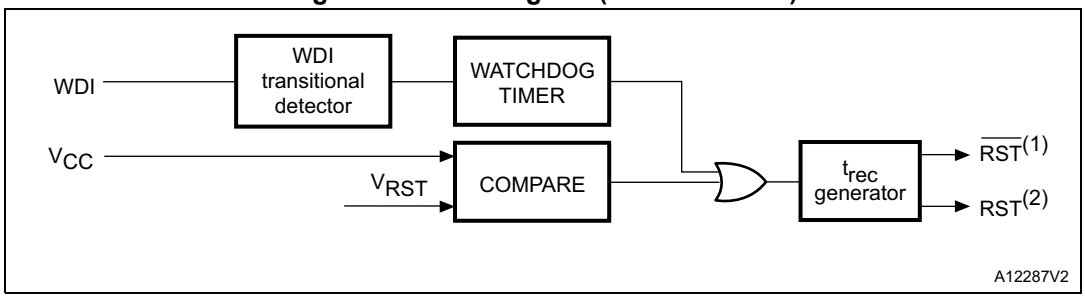
Pin				Name	Function
STM6822 STM6823	STM6821	STM6321 STM6824	STM6322 STM6825		
1	—	1	1	$\overline{RST}$	Active low reset output
3	3	—	4	$\overline{MR}$	Push-button reset input
4	4	4	—	WDI	Watchdog Input
—	1	3	3	RST	Active high reset output
5	5	5	5	V_{CC}	Supply voltage
2	2	2	2	V_{SS}	Ground

Figure 7. Block diagram (STM6821/6822/6823)



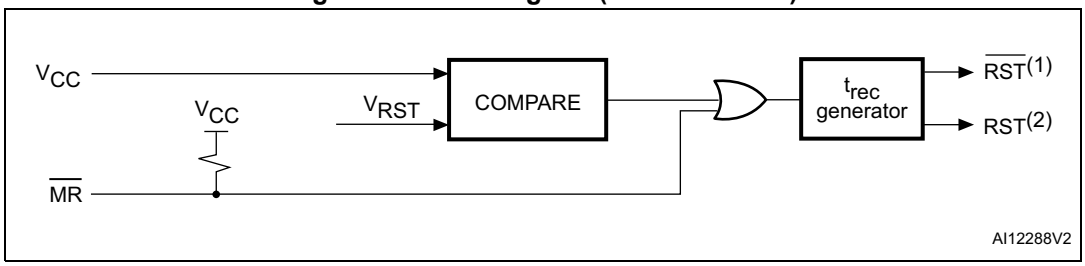
1. Push-pull for STM6823, open drain for STM6822.
2. Active high (push-pull) for STM6821.

Figure 8. Block diagram (STM6321/6824)



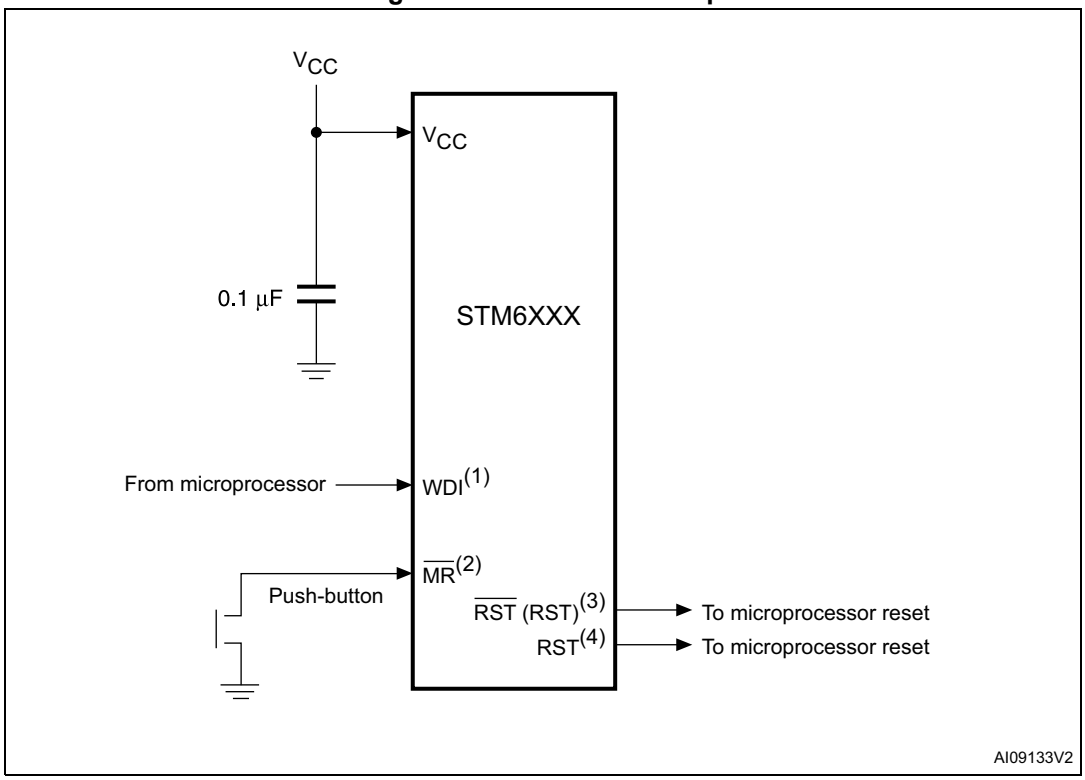
1. Active low (open drain) for STM6321, active low (push-pull) for STM6824.
2. Push-pull only.

Figure 9. Block diagram (STM6322/6825)



1. Active low (open drain) for STM6322, active low (push-pull) for STM6825.
2. Push-pull only.

Figure 10. Hardware hookup



1. For STM6321/6821/6822/6823/6824.
2. For STM6322/6821/6822/6823/6825.
3. For STM6821/ (RST output only).
4. For STM6321/6322/6824/6825 (both RST and $\overline{\text{RST}}$ outputs).

2 Operation

2.1 Reset output

The STM6xxx supervisor asserts a reset signal to the MCU whenever V_{CC} goes below the reset threshold (V_{RST}), a watchdog timeout occurs, or when the push-button reset input ($\overline{MR}$) is taken low. Reset is guaranteed valid for $V_{CC} < V_{RST}$ down to V_{CC} =1 V for T_A = 0 to 85 °C.

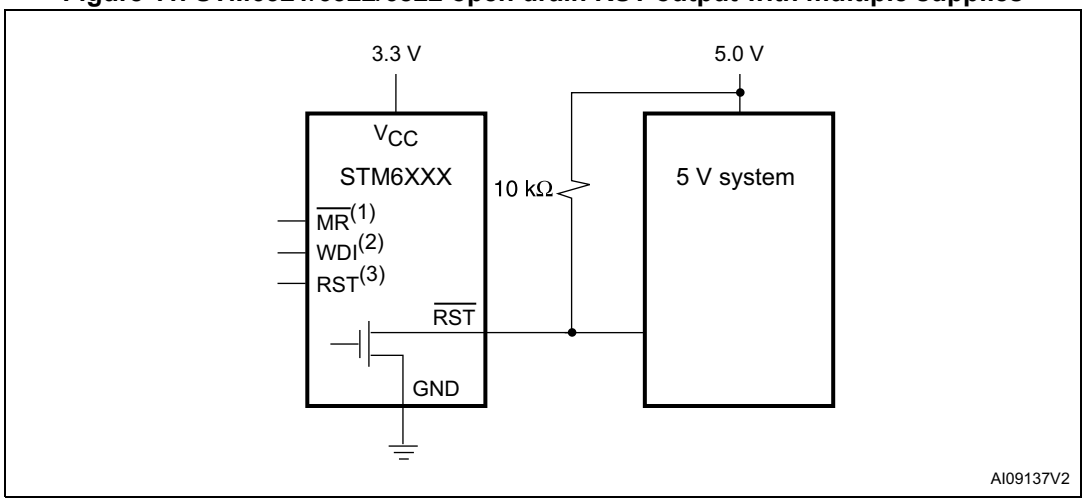
During power-up, once V_{CC} exceeds the reset threshold an internal timer keeps reset low for the reset timeout period, t_{rec}. After this interval reset is de-asserted.

Each time $\overline{RST}$ is asserted, it stays low for at least the reset timeout period (t_{rec}). 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 Open drain $\overline{RST}$ output

The STM6321/6322/6822 have 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 6 V (see *Figure 11*). 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 10 kΩ pull-up resistor is sufficient in most applications.

Figure 11. STM6321/6322/6822 open drain $\overline{RST}$ output with multiple supplies



1. STM6322/6822.
2. STM6321/6822.
3. STM6321/6322.

2.3 Push-button reset input (STM6322/6821/6822/6823/6825)

A logic low on $\overline{MR}$ asserts reset. Reset remains asserted while $\overline{MR}$ is low, and for t_{rec} (see *Figure 25 on page 19*) after it returns high. The $\overline{MR}$ input has an internal 52 kΩ pull-up resistor, allowing it to be left open if not used. This input can be driven with TTL/CMOS-logic levels or with open drain/collector outputs. Connect a normally open momentary switch from $\overline{MR}$ to GND to create a manual reset function; external debounce circuitry is not required. If $\overline{MR}$ is driven from long cables or the device is used in a noisy environment, connect a 0.1 µF capacitor from $\overline{MR}$ to GND to provide additional noise immunity. $\overline{MR}$ may float, or be tied to V_{CC} when not used.

2.4 Watchdog input (STM6321/6821/6822/6823/6824)

The watchdog timer can be used to detect an out-of-control MCU. If the MCU does not toggle the Watchdog Input (WDI) within t_{WD} (1.6 sec), the reset is asserted. The internal watchdog timer is cleared by either:

1. a reset pulse, or
2. by toggling WDI (high to low or low to high), which can detect pulses as short as 50 ns.

The timer remains cleared and does not count for as long as reset is asserted. As soon as reset is released, the timer starts counting.

Note: The watchdog function may be disabled by floating WDI or tristating the driver connected to WDI. When tristated or disconnected, the maximum allowable leakage current is 10 µA and the maximum allowable load capacitance is 200 pF.

2.5 Applications information

2.5.1 Watchdog input current

The WDI input is internally driven through a buffer and series resistor from the watchdog counter. For minimum watchdog input current (minimum overall power consumption), leave WDI low for the majority of the watchdog timeout period. When high, WDI can draw as much as 160 µA. Pulsing WDI high at a low duty cycle will reduce the effect of the large input current. When WDI is left unconnected, the watchdog timer is serviced within the watchdog timeout period by a low-high-low pulse from the counter chain.

2.5.2 Ensuring a valid reset output down to V_{CC} = 0 V

The STM6xxx supervisors are guaranteed to operate properly down to V_{CC} = 1 V. In applications that require valid reset levels down to V_{CC} = 0, a pull-down resistor to active low outputs (push/pull only, see *Figure 12 on page 12*) and a pull-up resistor to active high outputs (push/pull only, see *Figure 13 on page 12*) will ensure that the reset line is valid while the reset output can no longer sink or source current. This scheme does not work with the open drain outputs of the STM6321/6322/6822.

The resistor value used is not critical, but it must be large enough not to load the reset output when V_{CC} is above the reset threshold. For most applications, 100 kΩ is adequate.

Figure 12. Ensuring $\overline{RST}$ valid to V_{CC} = 0, (active low push-pull outputs)

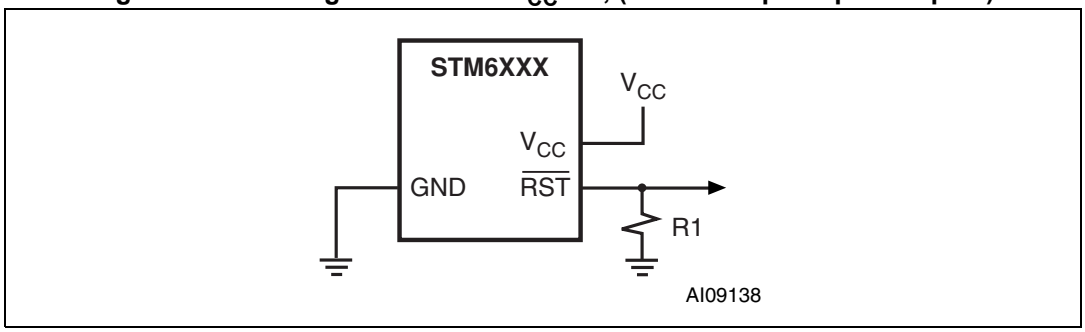
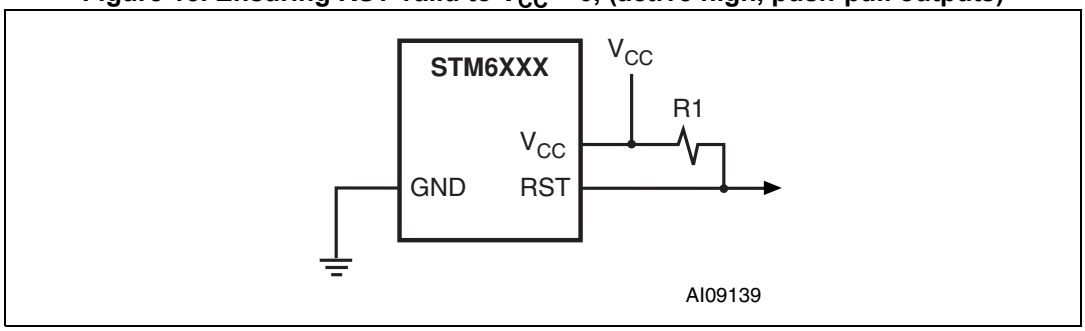


Figure 13. Ensuring RST valid to V_{CC} = 0, (active high, push-pull outputs)

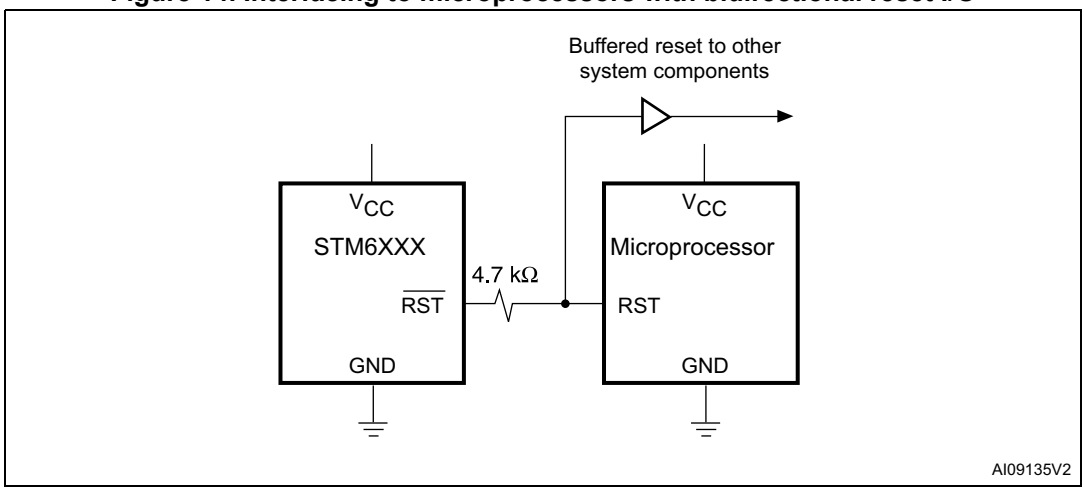


1. This configuration does not work on open drain outputs of the STM6321/6322/6822.

2.6 Interfacing to microprocessors with bidirectional reset pins

Microprocessors with bidirectional reset pins can contend with the STM6321/6322/6821/6822/6823/6824/6825 reset output. For example, if the reset output is driven high and the microprocessor wants to pull it low, signal contention will result. To prevent this from occurring, connect a 4.7 kΩ resistor between the reset output and the microprocessor's reset I/O as in *Figure 14*.

Figure 14. Interfacing to microprocessors with bidirectional reset I/O



3 Typical operating characteristics

Figure 15. V_{CC}-to-reset output delay vs. temperature

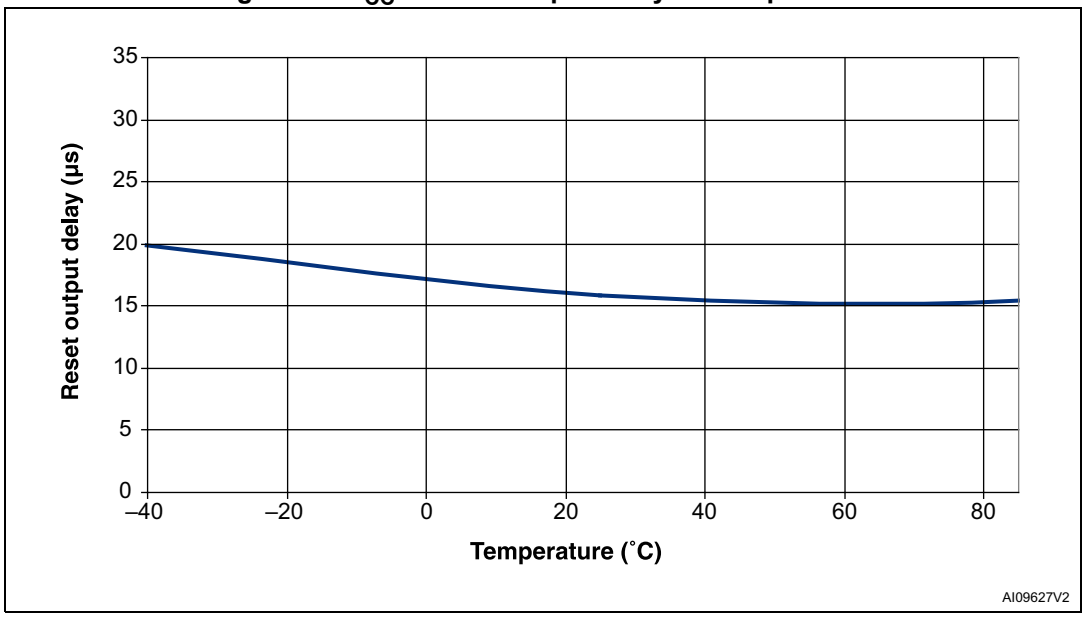


Figure 16. Supply current vs. temperature

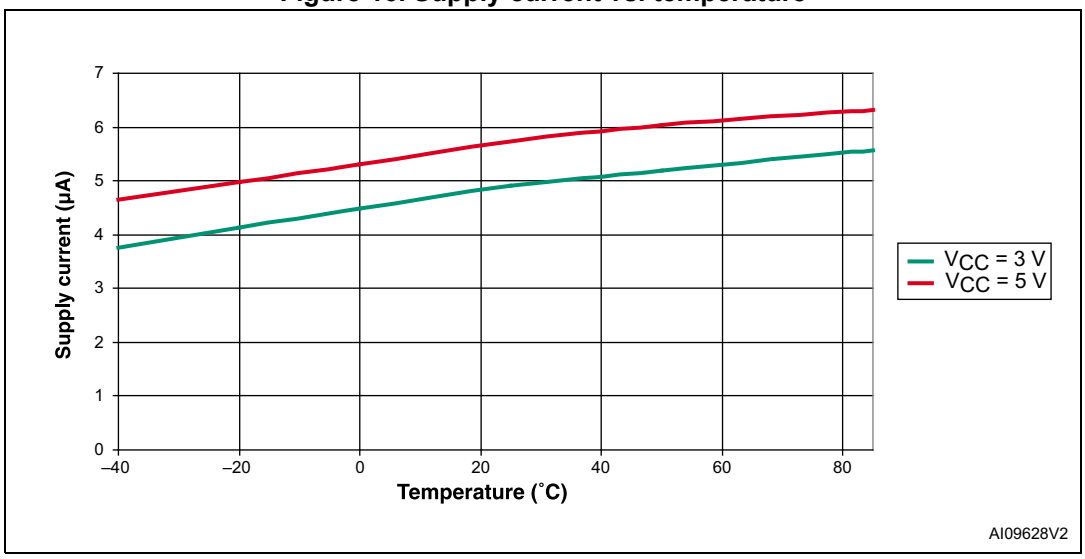


Figure 17. $\overline{MR}$-to-reset output delay vs. temperature

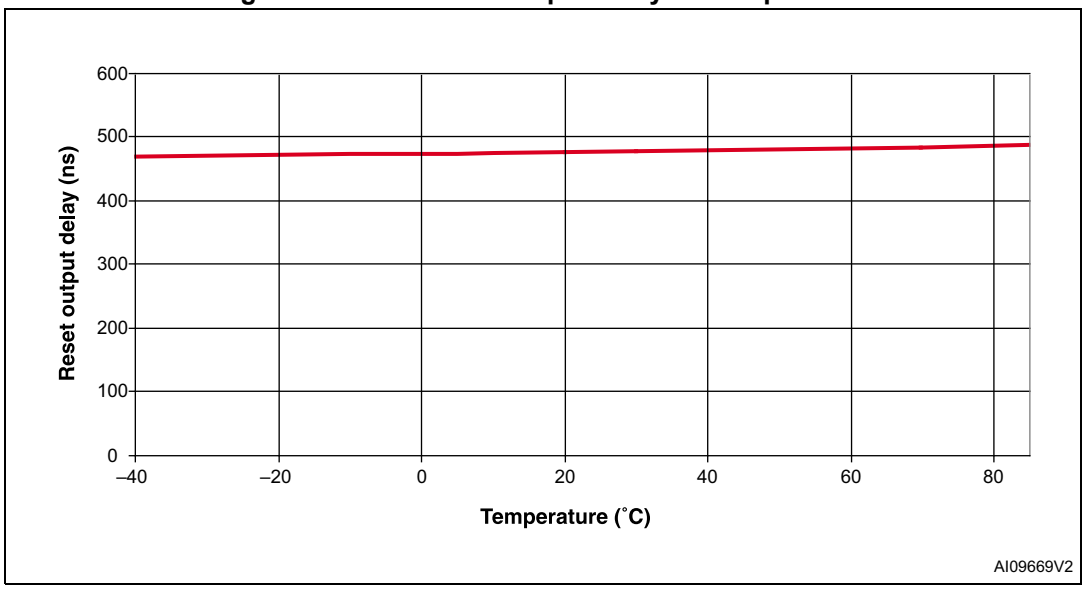


Figure 18. Normalized power-up t_{rec} vs. temperature

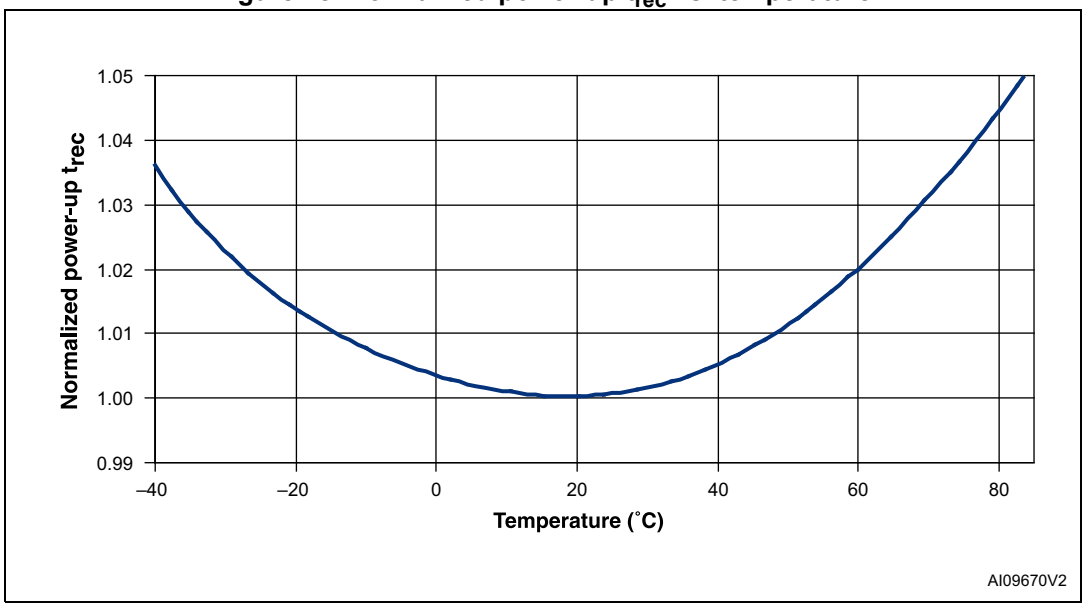


Figure 19. Normalized reset threshold voltage vs. temperature

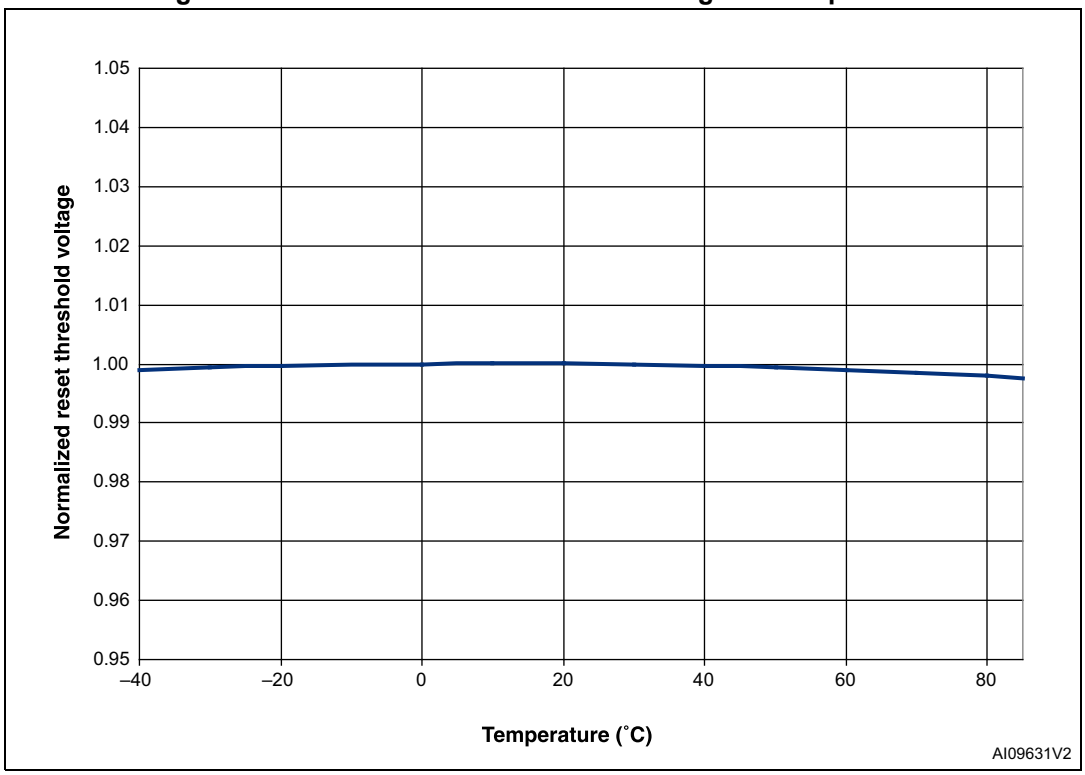


Figure 20. Normalized power-up watchdog timeout period

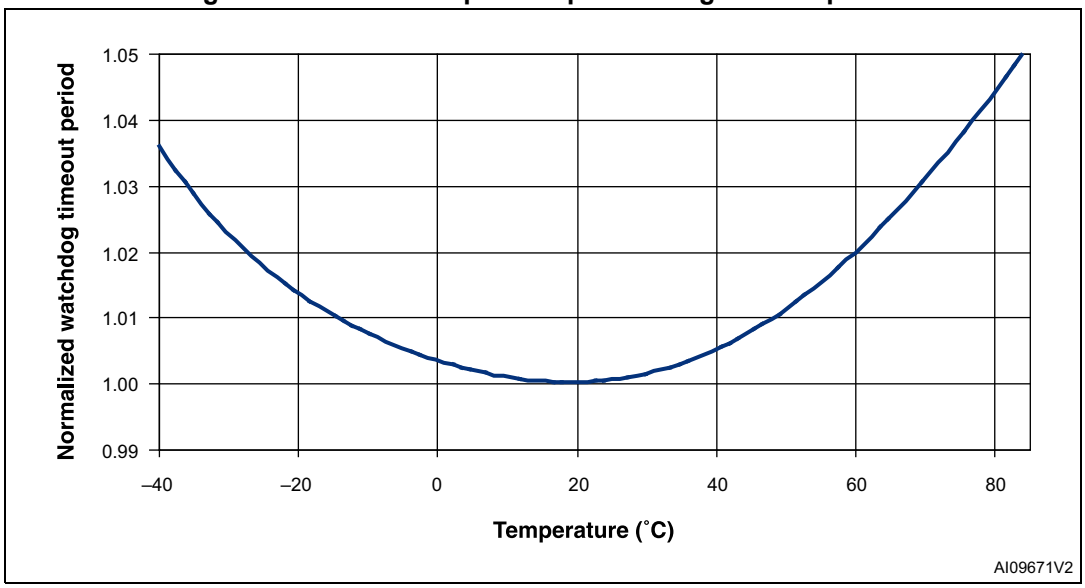


Figure 21. Voltage output low vs. I_{SINK}

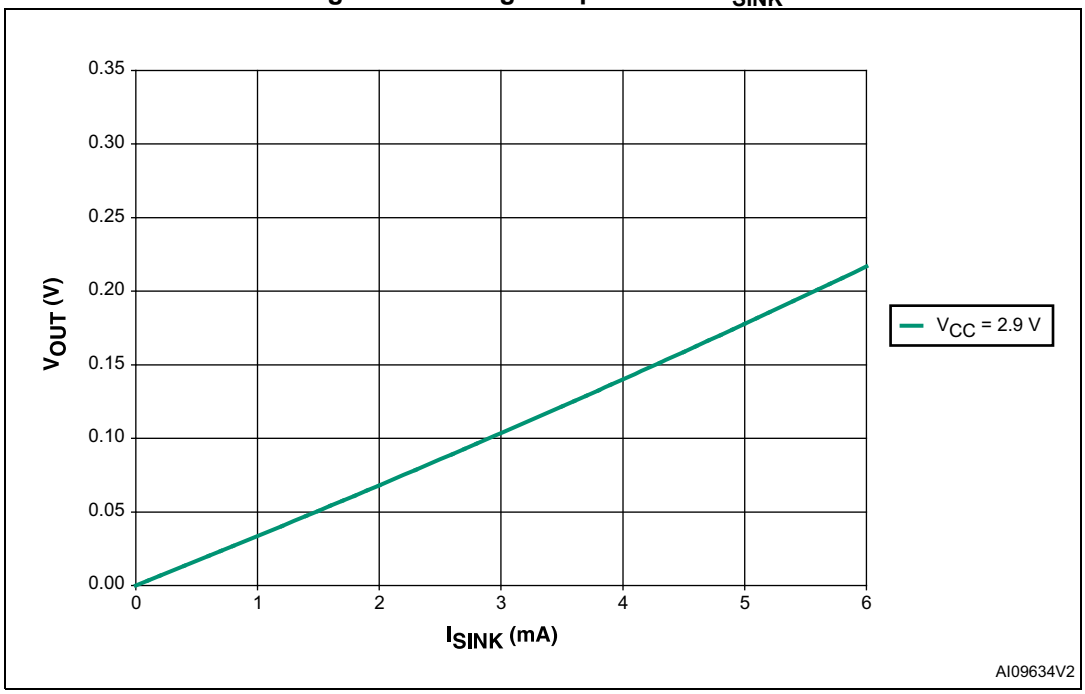


Figure 22. Voltage output high vs. I_{SOURCE}

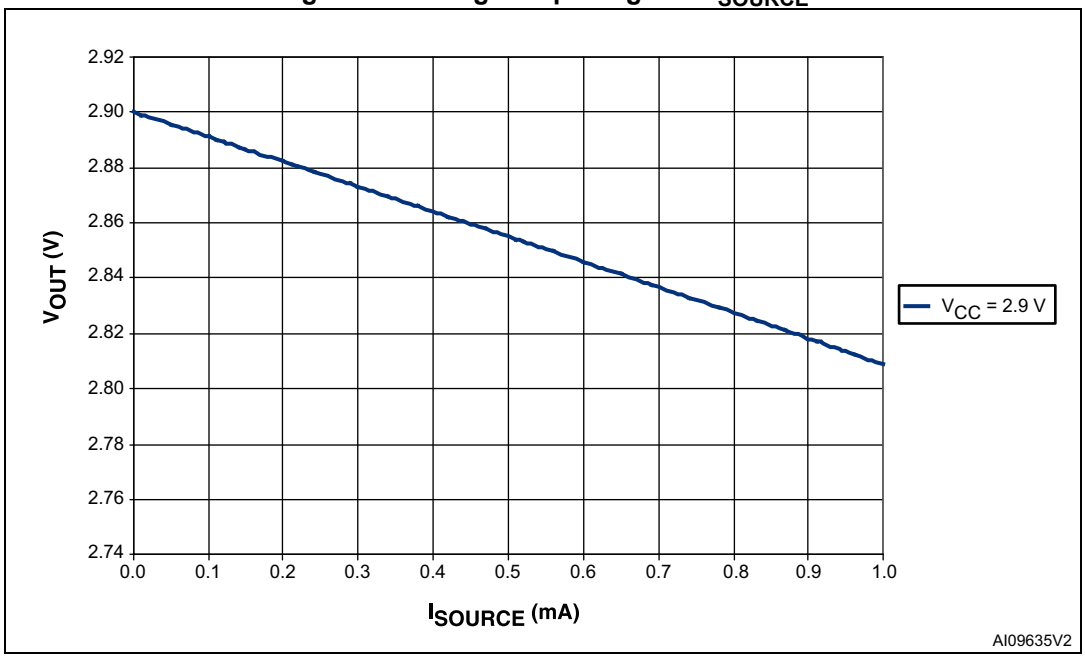
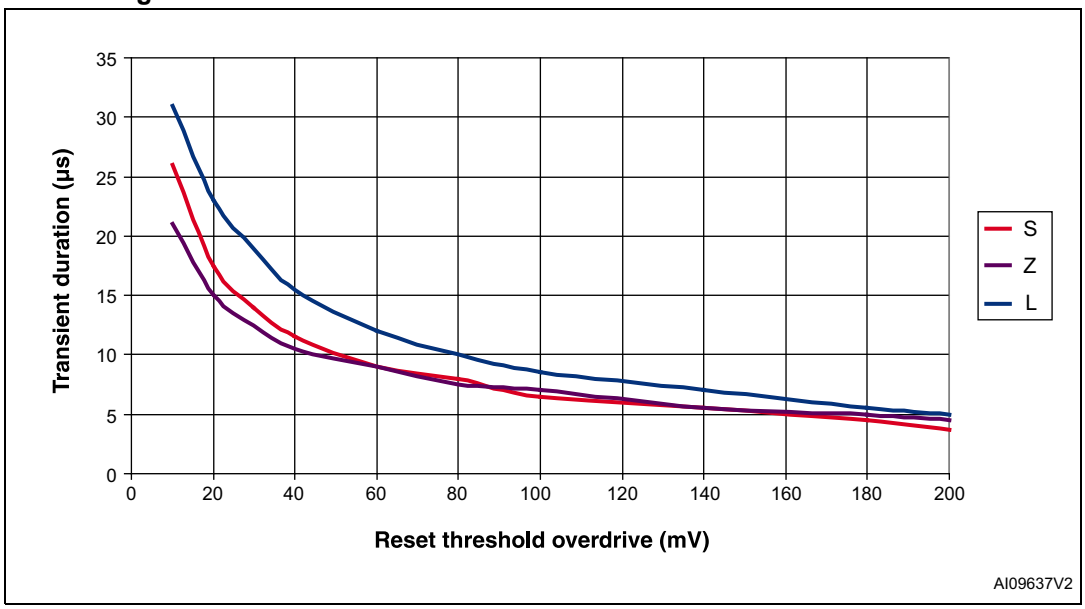


Figure 23. Maximum transient duration vs. reset threshold overdrive



4 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 *Table 5: Operating and AC 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 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
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 *Table 6: DC and AC characteristics*, are derived from tests performed under the measurement conditions summarized in *Table 5: 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 5. Operating and AC measurement conditions

Parameter	STM6xxx	Unit
V_{CC} supply voltage	1.0 to 5.5	V
Ambient operating temperature (T_A)	–40 to 85	°C
Input rise and fall times	≤ 5	ns
Input pulse voltages	0.2 to 0.8 V_{CC}	V
Input and output timing ref. voltages	0.3 to 0.7 V_{CC}	V

Figure 24. AC testing input/output waveforms

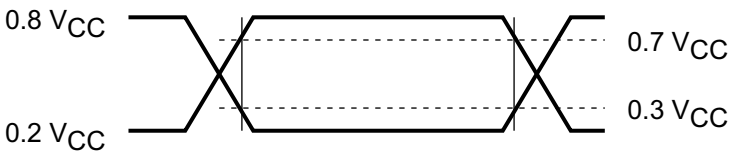
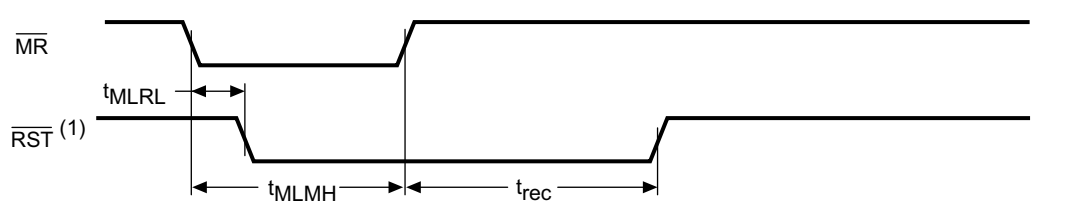


Figure 25. $\overline{MR}$ timing waveform



1. RST for STM6322/6821/6825.

Figure 26. Watchdog timing

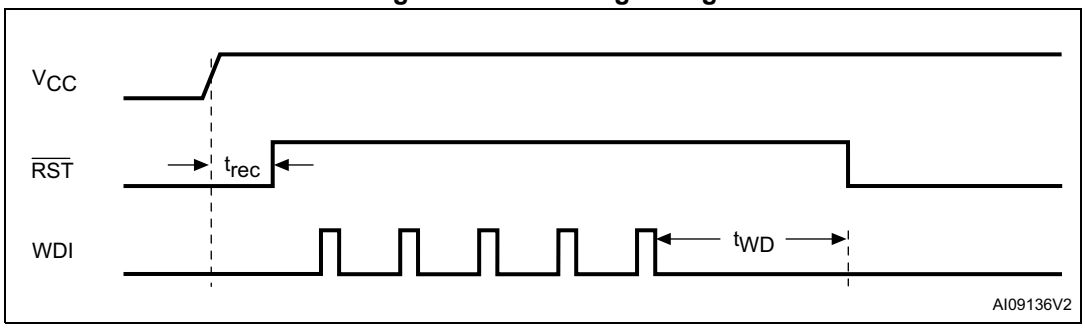


Table 6. DC and AC characteristics

Sym-bol	Alter-native	Description	Test condition(1)	Min.	Typ.	Max.	Unit
V_{CC}		Operating voltage		1.2 (2)		5.5	V
I_{CC}		V_{CC} supply current ($\overline{MR}$ and WDI unconnected)	T/S/R/Z/Y (V_{CC} < 3.6 V)		4	12	µA
			L/M (V_{CC} < 5.5 V)		6	17	µA
		V_{CC} supply current ($\overline{MR}$ unconnected; STM6322/6825)	T/S/R/Z/Y (V_{CC} < 3.6 V)		3	8	µA
			L/M (V_{CC} < 5.5 V)		3	12	µA
I_{LI}		Input leakage current	0 V = V_{IN} = V_{CC}	–1		+1	µA
		Input leakage current (WDI)(3)	WDI = V_{CC}, time average		120	160	µA
			WDI = GND, time average	–20	–15		µA
I_{LO}		Open drain reset output leakage current	V_{CC} > V_{RST}, Reset not asserted	–1		+1	µA
V_{IH}		Input high voltage ($\overline{MR}$)	V_{RST} > 4.0 V	2.0			V
			V_{RST} < 4.0 V	0.7 V_{CC}			V
V_{IH}		Input high voltage (WDI)(4)	V_{RST} (max.) < V_{CC} < 5.5 V	0.7 V_{CC}			V
V_{IL}		Input low voltage ($\overline{MR}$)	V_{RST} > 4.0 V			0.8	V
			V_{RST} < 4.0 V			0.3 V_{CC}	V
V_{IL}		Input low voltage (WDI)(4)	V_{RST} (max.) < V_{CC} < 5.5 V			0.3 V_{CC}	V
V_{OL}		Output low voltage ($\overline{RST}$; push-pull or open drain)	V_{CC} ≥ 1.0 V, I_{SINK} = 50 µA, Reset asserted			0.3	V
			V_{CC} ≥ 1.2 V, I_{SINK} = 100 µA, Reset asserted			0.3	V
			V_{CC} ≥ 2.7 V, I_{SINK} = 1.2 mA, Reset asserted			0.3	V
			V_{CC} ≥ 4.5 V, I_{SINK} = 3.2 mA, Reset asserted			0.4	V
		Output low voltage (RST; push-pull only)	V_{CC} ≥ 2.7 V, I_{SINK} = 1.2 mA, Reset not asserted			0.3	V
			V_{CC} ≥ 4.5 V, I_{SINK} = 3.2 mA, Reset not asserted			0.4	V

Table 6. DC and AC characteristics (continued)

Sym-bol	Alter-native	Description	Test condition(1)		Min.	Typ.	Max.	Unit
V_{OH}		Output high voltage ($\overline{RST}$)	$V_{CC} \geq 2.7$ V, I_{SOURCE} = 500 µA, Reset not asserted		0.8 V_{CC}			V
			$V_{CC} \geq 4.5$ V, I_{SOURCE} = 800 µA , Reset not asserted		0.8 V_{CC}			V
		Output high voltage (RST)	$V_{CC} \geq 1.0$ V, I_{SOURCE} = 1 µA, Reset asserted (0 °C to 85 °C)		0.8 V_{CC}			V
			$V_{CC} \geq 1.5$ V, I_{SOURCE} = 100 µA, Reset asserted		0.8 V_{CC}			V
			$V_{CC} \geq 2.55$ V, I_{SOURCE} = 500 µA, Reset asserted		0.8 V_{CC}			V
			$V_{CC} \geq 4.25$ V, I_{SOURCE} = 800 µA, Reset asserted		0.8 V_{CC}			V
Reset thresholds								
V_{RST}(5)		Reset threshold	STM6xxxL	25 °C	4.561	4.630	4.699	V
				–40 to 85 °C	4.514		4.746	V
			STM6xxxM	25 °C	4.314	4.390	4.446	V
				–40 to 85 °C	4.270		4.490	V
			STM6xxxT	25 °C	3.040	3.080	3.110	V
				–40 to 85 °C	3.000		3.150	V
			STM6xxxS	25 °C	2.890	2.930	2.960	V
				–40 to 85 °C	2.857		3.000	V
			STM6xxxR	25 °C	2.590	2.630	2.660	V
				–40 to 85 °C	2.564		2.696	V
			STM6xxxZ	25 °C	2.266	2.300	2.335	V
				–40 to 85 °C	2.243		2.358	V
			STM6xxxY	25 °C	1.970	2.000	2.030	V
				–40 to 85 °C	1.950		2.050	V
		Reset threshold hysteresis	L/M versions			10		mV
			T/S/R/Z/Y versions			5		mV
		V_{CC} to $\overline{RST}$ delay ($V_{RST} - V_{CC}$ = 100 mV, V_{CC} falling at 1 mV/µs)				20		µs
t_{rec} (6)		Reset pulse width	A		1	1.4	2	ms
			Blank		140	200	280	ms
			J		240	360	480	ms

Table 6. DC and AC characteristics (continued)

Sym-bol	Alter-native	Description	Test condition(1)	Min.	Typ.	Max.	Unit
		Reset threshold temperature coefficient			40		ppm/C
Push-button reset input							
t_{MLMH}	t_{MR}	$\overline{MR}$ pulse width		1			µs
t_{MLRL}	t_{MRD}	$\overline{MR}$ to $\overline{RST}$ output delay			500		ns
		$\overline{MR}$ glitch immunity			100		ns
		$\overline{MR}$ pull-up resistor		35	52	75	kΩ
Watchdog timer							
t_{WD} (6)		Watchdog timeout period		1.12	1.60	2.24	s
		WDI pulse width(7)	$V_{CC} \geq 3.0$ V	50			ns

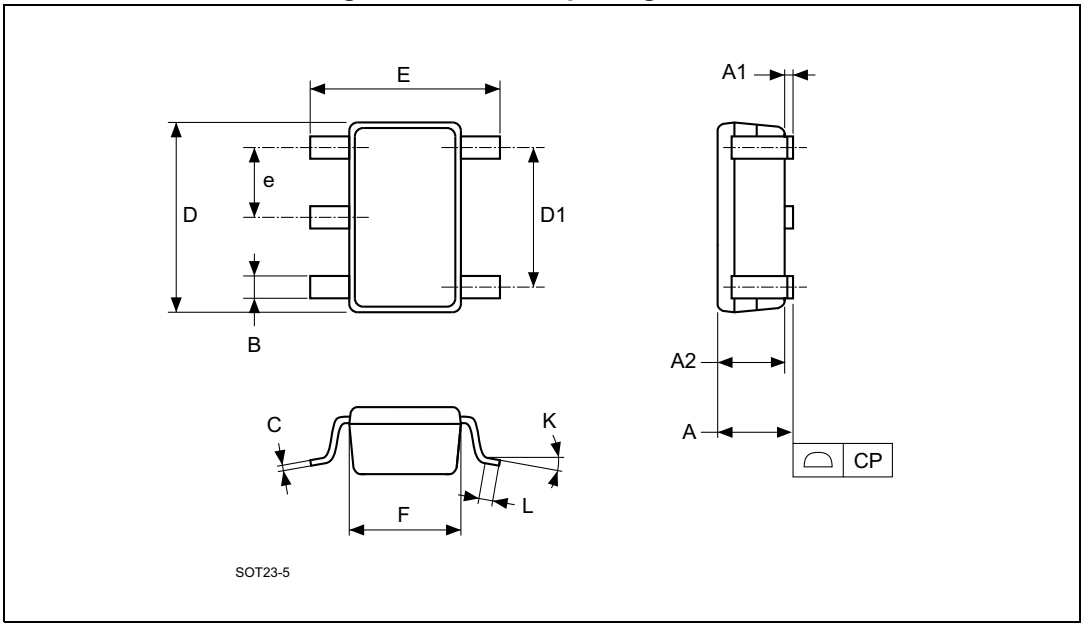
1. Valid for ambient operating temperature: T_A = –40 to 85 °C; V_{CC} = 4.5 to 5.5 V for “L/M” versions; V_{CC} = 2.7 to 3.6 V for “T/S/R” versions; and V_{CC} = 1.2 to 2.75 V for “Z/Y” version (except where noted).
2. V_{CC} (min.) = 1.0 V for T_A = 0 to +85 °C.
3. WDI input is designed to be driven by a three-state output device. To float WDI, the “high-impedance mode” of the output device must have a maximum leakage current of 10 µA and a maximum output capacitance of 200 pF. The output device must also be able to source and sink at least 200 µA when active.
4. WDI is internally serviced within the watchdog period if WDI is left unconnected.
5. The leakage current measured on the RST pin is tested with the reset asserted (output high impedance).
6. Other t_{rec} offered for t_{WD} (102 ms, 6.3 ms, and 25.6 s options). Minimum order quantities may apply. Contact local sales office for availability.
7. For V_{CC} < 3.0 V, t_{WD}(min.) = 100 ns.

6 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.

6.1 SOT23-5 package information

Figure 27. SOT23-5 package outline



1. Drawing is not to scale.

Table 7. SOT23-5 mechanical data

Symbol	Dimensions					
	mm			inches		
	Typ.	Min.	Max.	Typ.	Min.	Max.
A	1.20	0.90	1.45	0.047	0.035	0.057
A1			0.15			0.006
A2	1.05	0.90	1.30	0.041	0.035	0.051
B	0.40	0.35	0.50	0.016	0.014	0.020
C	0.15	0.09	0.20	0.006	0.004	0.008
D	2.90	2.80	3.00	0.114	0.110	0.118
D1	1.90			0.075		
E	2.80	2.60	3.00	0.110	0.102	0.118
e	0.95			0.037		
F	1.60	1.50	1.75	0.063	0.059	0.069
K		0°	10°		0°	10°
L	0.35	0.10	0.60	0.014	0.004	0.024