



# STM690A, STM692A, STM703 STM704, STM802, STM805, STM817/8/9

## 5V Supervisor with Battery Switchover

### FEATURES SUMMARY

- 5V OPERATING VOLTAGE
- NVRAM SUPERVISOR FOR EXTERNAL LPSRAM
- CHIP-ENABLE GATING (STM818 only) FOR EXTERNAL LPSRAM (7ns max PROP DELAY)
- RST AND  $\overline{\text{RST}}$  OUTPUTS
- 200ms (TYP)  $t_{\text{rec}}$
- WATCHDOG TIMER - 1.6sec (TYP)
- AUTOMATIC BATTERY SWITCHOVER
- LOW BATTERY SUPPLY CURRENT - 0.4 $\mu$ A (TYP)
- POWER-FAIL COMPARATOR (PFI/ $\overline{\text{PFO}}$ )
- LOW SUPPLY CURRENT - 40 $\mu$ A (TYP)
- GUARANTEED  $\overline{\text{RST}}$  (RST) ASSERTION DOWN TO  $V_{\text{CC}} = 1.0\text{V}$
- OPERATING TEMPERATURE:  
-40°C to 85°C (Industrial Grade)

Figure 1. Packages

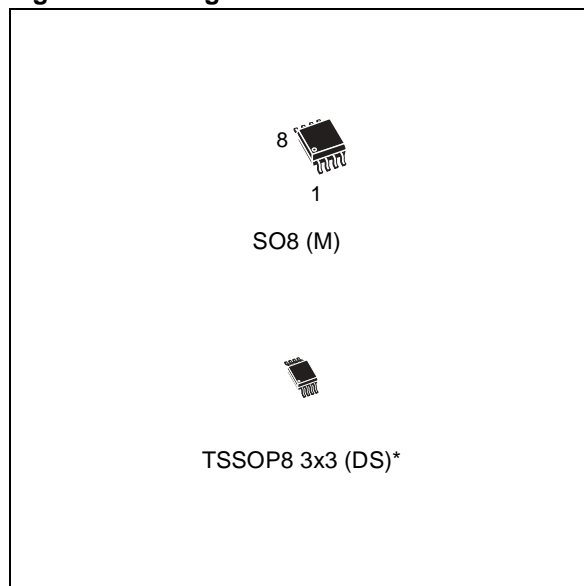


Table 1. Device Options

	Watchdog Input	Active-Low $\overline{\text{RST}}$ (1)	Active-High RST(1)	Manual Reset Input	Battery Switchover	Power-fail Comparator	Chip-Enable Gating	Battery Freshness Seal
STM690A	✓	✓			✓	✓		
STM692A	✓	✓			✓	✓		
STM703		✓		✓	✓	✓		
STM704		✓		✓	✓	✓		
STM802L/M	✓	✓			✓	✓		
STM805L	✓		✓		✓	✓		
STM817L/M	✓	✓			✓	✓		✓
STM818L/M	✓	✓			✓		✓	✓
STM819L/M		✓		✓	✓	✓		✓

Note: 1. All  $\overline{\text{RST}}$  and RST outputs are push-pull.

\* Contact local ST sales office for availability.

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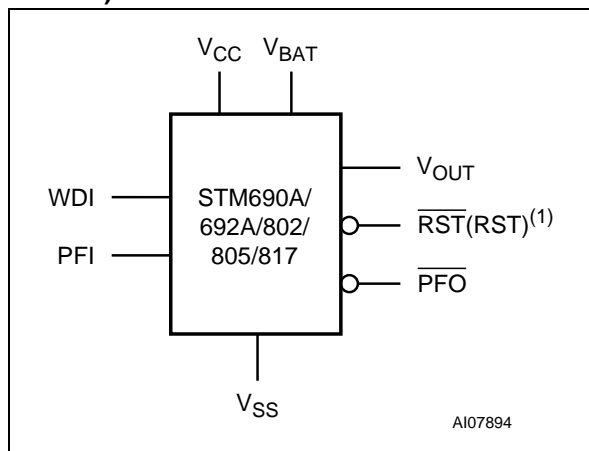
**SUMMARY DESCRIPTION**

The STM690A/692A/703/704/802/805/817/818/819 Supervisors are self-contained devices which provide microprocessor supervisory functions with the ability to non-volatize and write-protect external LPSRAM. A precision voltage reference and comparator monitors the V<sub>CC</sub> input for an out-of-tolerance condition. When an invalid V<sub>CC</sub> condition occurs, the reset output (RST) is forced low (or high in the case of RST). These devices also

offer a watchdog timer (except for STM703/704/819) as well as a power-fail comparator (except for STM818) to provide the system with an early warning of impending power failure.

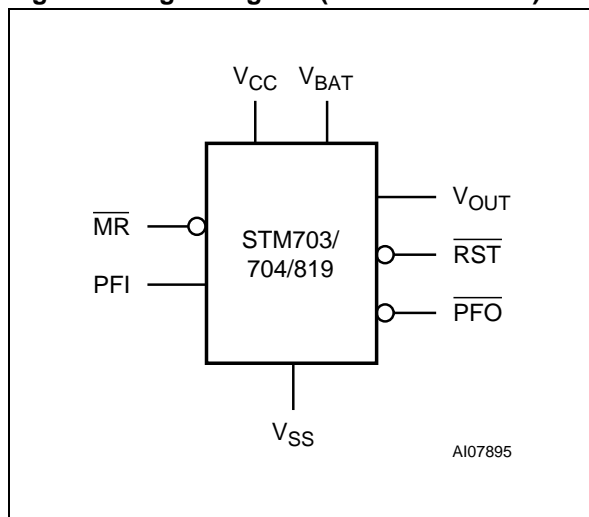
These devices are available in a standard 8-pin SOIC package or a space-saving 8-pin TSSOP package.

**Figure 2. Logic Diagram (STM690A/692A/802/805/817)**

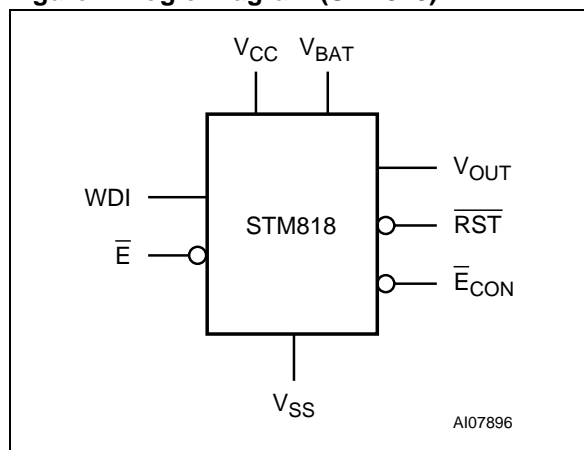


Note: 1. For STM805, reset output is active-high.

**Figure 3. Logic Diagram (STM703/704/819)**



**Figure 4. Logic Diagram (STM818)**

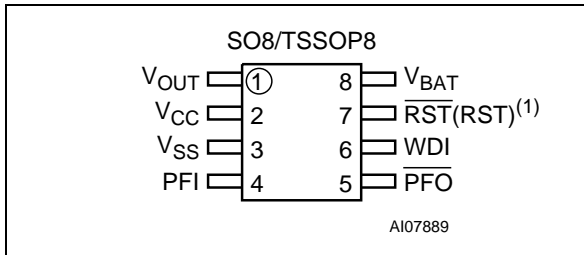


**Table 2. Signal Names**

MR	Push-button Reset Input
WDI	Watchdog Input
RST	Active-Low Reset Output
RST	Active-High Reset Output
E <sup>(1)</sup>	Chip Enable Input
E <sup>CON</sup> (1)	Conditioned Chip Enable Output
V <sub>OUT</sub>	Supply Voltage Output
V <sub>CC</sub>	Supply Voltage
V <sub>BAT</sub>	Back-up Supply Voltage
PFI	Power-fail Input
PFO	Power-fail Output
V <sub>SS</sub>	Ground

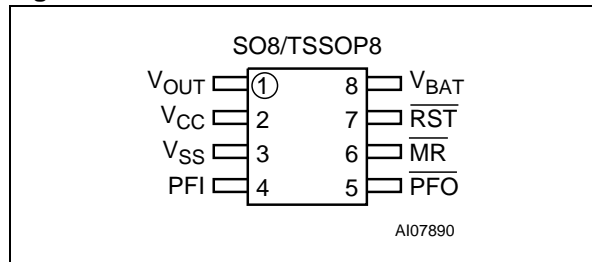
Note: 1. STM818

**Figure 5. STM690A/692A/802/805/817 Connections**

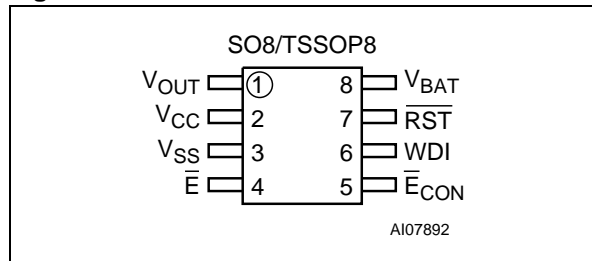


Note: 1. For STM805, reset output is active-high.

**Figure 6. STM703/704/819 Connections**



**Figure 7. STM818 Connections**



**Pin Descriptions**

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

**WDI.** If WDI remains high or low for 1.6sec, the internal watchdog timer runs out and reset is triggered. The internal watchdog timer clears while reset is asserted or when WDI sees a rising or falling edge.

The watchdog function can be disabled by allowing the WDI pin to float.

**RST.** Pulses low for  $t_{rec}$  when triggered, and stays low whenever  $V_{CC}$  is below the reset threshold or when 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 MR goes from low to high.

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

**V<sub>OUT</sub>.** When  $V_{CC}$  is above the switchover voltage ( $V_{SO}$ ),  $V_{OUT}$  is connected to  $V_{CC}$  through a P-channel MOSFET switch. When  $V_{CC}$  falls below  $V_{SO}$ ,  $V_{BAT}$  connects to  $V_{OUT}$ . Connect to  $V_{CC}$  if no battery is used.

**V<sub>BAT</sub>.** When  $V_{CC}$  falls below  $V_{SO}$ ,  $V_{OUT}$  switches from  $V_{CC}$  to  $V_{BAT}$ . When  $V_{CC}$  rises above  $V_{SO} +$  hysteresis,  $V_{OUT}$  reconnects to  $V_{CC}$ .  $V_{BAT}$  may exceed  $V_{CC}$ . Connect to  $V_{CC}$  if no battery is used.

**E.** The input to the chip-enable gating circuit. Connect to ground if unused.

**E<sub>CON</sub>.**  $\bar{E}_{CON}$  goes low only when  $\bar{E}$  is low and reset is not asserted. If  $\bar{E}_{CON}$  is low when reset is asserted,  $\bar{E}_{CON}$  will remain low for 15 $\mu$ s or until  $\bar{E}$  goes high, whichever occurs first. In the disabled mode,  $\bar{E}_{CON}$  is pulled up to  $V_{OUT}$ .

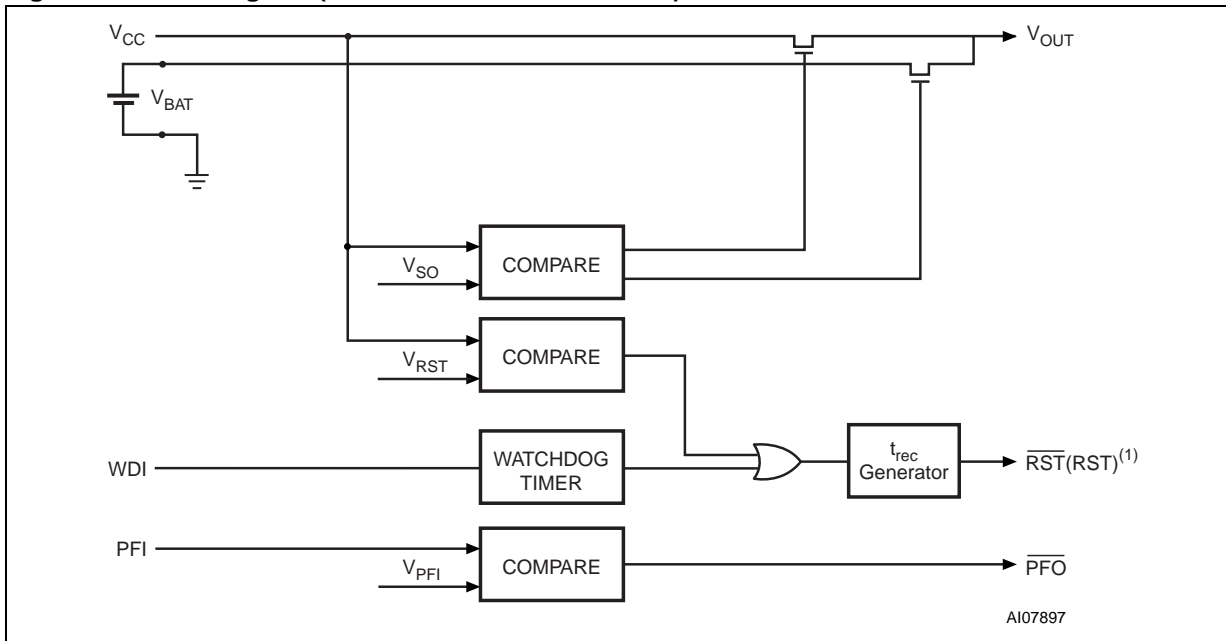
**PFI.** When PFI is less than  $V_{PFI}$  or when  $V_{CC}$  falls below 2.4V (or  $V_{SO}$ ),  $\bar{PFO}$  goes low; otherwise,  $\bar{PFO}$  remains high. Connect to ground if unused.

**PFO.** When PFI is less than  $V_{PFI}$ , or  $V_{CC}$  falls below 2.4V (or  $V_{SO}$ ),  $\bar{PFO}$  goes low; otherwise,  $\bar{PFO}$  remains high. Leave open if unused.

**Table 3. Pin Description**

STM818	Pin			Name	Function
	STM690A STM692A STM802 STM817	STM703 STM704 STM819	STM805		
–	–	6	–	MR	Push-button Reset Input
6	6	–	6	WDI	Watchdog Input
7	7	7	–	RST	Active-Low Reset Output
–	–	–	7	RST	Active-High Reset Output
1	1	1	1	V <sub>OUT</sub>	Supply Output for External LPSRAM
2	2	2	2	V <sub>CC</sub>	Supply Voltage
8	8	8	8	V <sub>BAT</sub>	Backup-Battery Input
4	–	–	–	E	Chip Enable Input
5	–	–	–	E <sub>CON</sub>	Conditioned Chip Enable Output
–	4	4	4	PFI	PFI Power-fail Input
–	5	5	5	PFO	PFO Power-fail Output
3	3	3	3	V <sub>SS</sub>	Ground

Figure 8. Block Diagram (STM690A/692A/802/805/817)



Note: 1. For STM805, reset output is active-high.

Figure 9. Block Diagram (STM703/704/819)

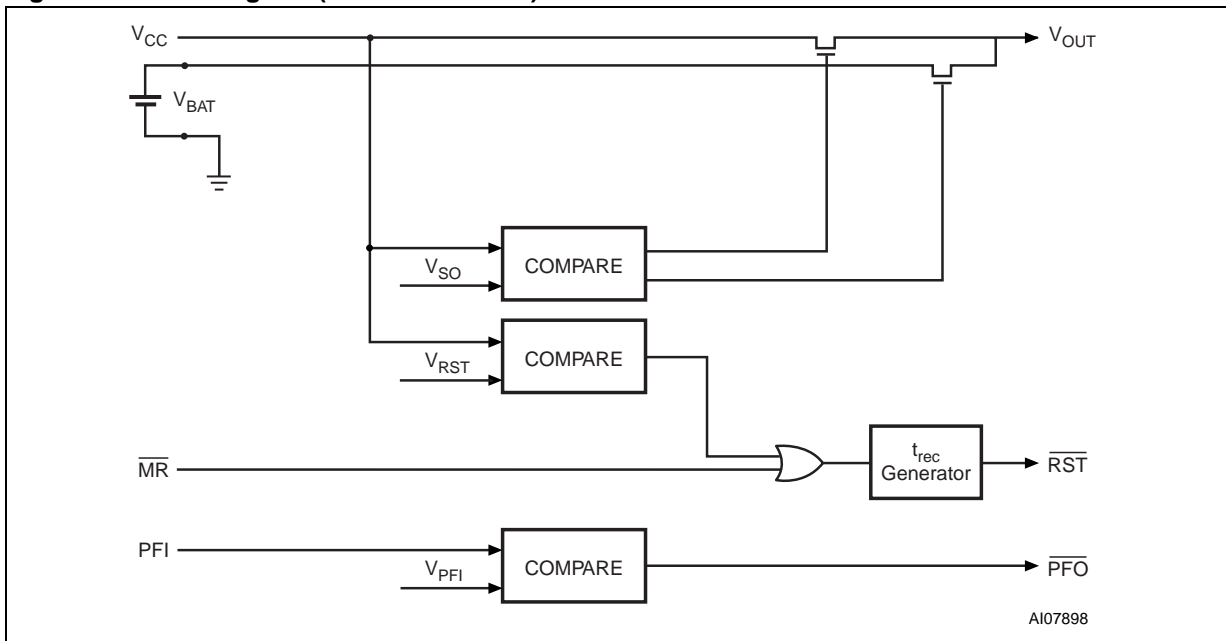


Figure 10. Block Diagram (STM818)

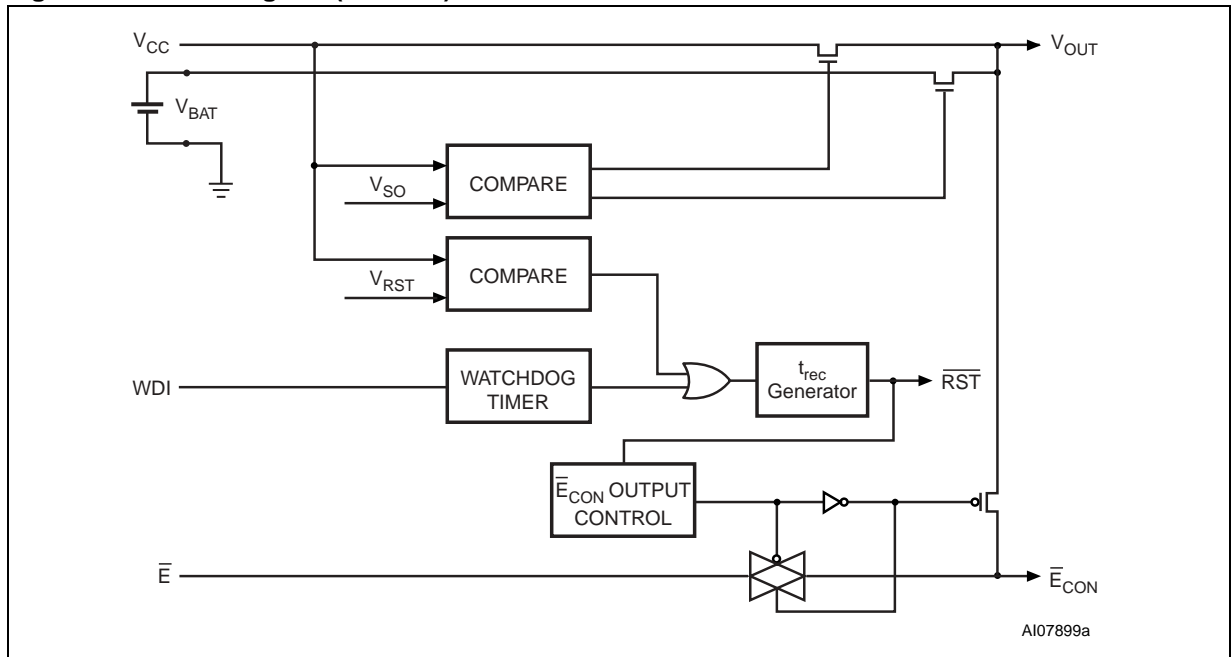
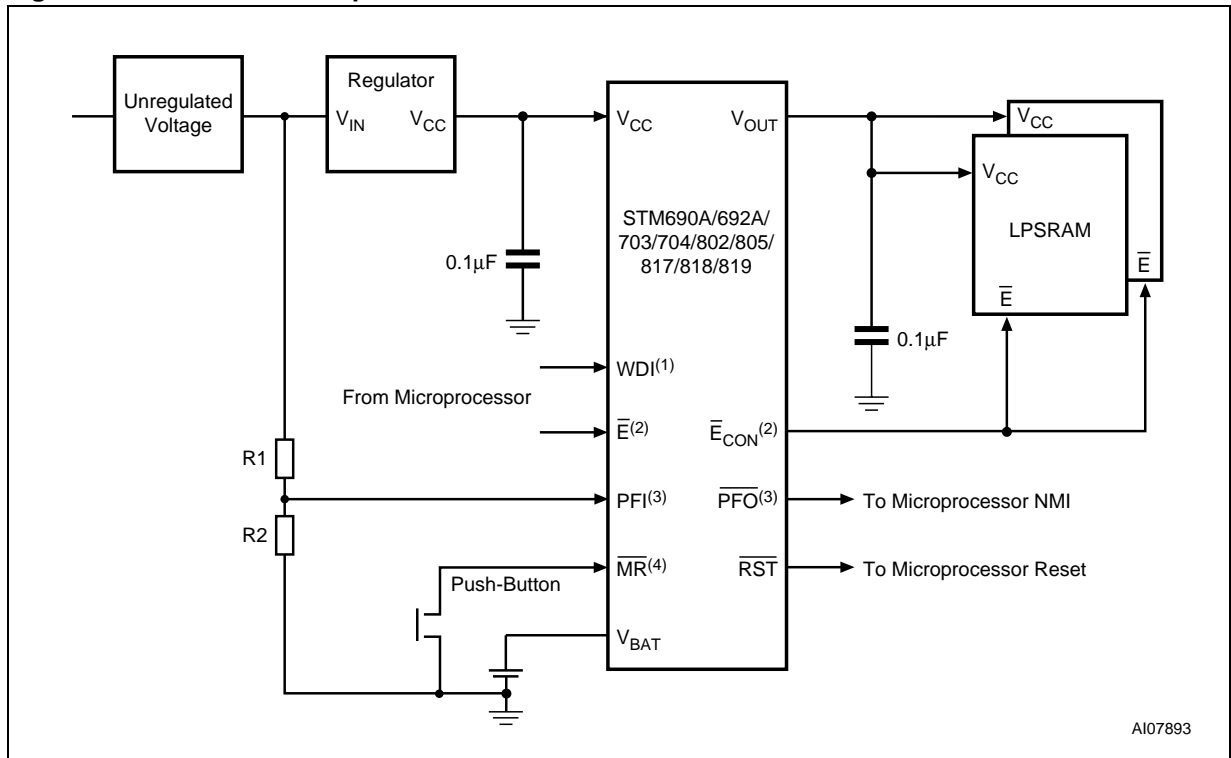


Figure 11. Hardware Hookup



Note: 1. For STM690A/692A/802/805/817/818.  
 2. For STM818 only.  
 3. Not available on STM818.  
 4. For STM703/704/819.



## OPERATION

### Reset Output

The STM690A/692A/703/704/802/805/817/818/819 Supervisor asserts a reset signal to the MCU whenever  $V_{CC}$  goes below the reset threshold ( $V_{RST}$ ), a watchdog time-out occurs, or when the Push-button Reset Input ( $\overline{MR}$ ) is taken low.  $\overline{RST}$  is guaranteed to be a logic low (logic high for STM805) for  $0V < V_{CC} < V_{RST}$  if  $V_{BAT}$  is greater than 1V. Without a back-up battery,  $\overline{RST}$  is guaranteed valid down to  $V_{CC} = 1V$ .

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 ( $t_{rec}$ ). 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.

### Push-button Reset Input (STM703/704/819)

A logic low on  $\overline{MR}$  asserts reset. Reset remains asserted while  $\overline{MR}$  is low, and for  $t_{rec}$  (see [Figure 42., page 28](#)) after it returns high. The  $\overline{MR}$  input has an internal 40k $\Omega$  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 $\mu$ F capacitor from  $\overline{MR}$  to GND to provide additional noise immunity.  $\overline{MR}$  may float, or be tied to  $V_{CC}$  when not used.

### Watchdog Input (NOT available on STM703/704/819)

The watchdog timer can be used to detect an out-of-control MCU. If the MCU does not toggle the Watchdog Input (WDI) within  $t_{WD}$  (1.6sec typ), 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 50ns. If WDI is tied high or low, a reset pulse is triggered every 1.8sec ( $t_{WD} + t_{rec}$ ).

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 (see [Figure 43., page 28](#)).

**Note:** The watchdog function may be disabled by floating WDI or tri-stating the driver connected to WDI. When tri-stated or disconnected, the maximum allowable leakage current is 10 $\mu$ A and the maximum allowable load capacitance is 200pF.

**Note:** Input frequency greater than 20ns (50MHz) will be filtered.

### Back-up Battery Switchover

In the event of a power failure, it may be necessary to preserve the contents of external SRAM through  $V_{OUT}$ . With a backup battery installed with voltage  $V_{BAT}$ , the devices automatically switch the SRAM to the back-up supply when  $V_{CC}$  falls.

**Note:** If back-up battery is not used, connect both  $V_{BAT}$  and  $V_{OUT}$  to  $V_{CC}$ .

This family of Supervisors does not always connect  $V_{BAT}$  to  $V_{OUT}$  when  $V_{BAT}$  is greater than  $V_{CC}$ .  $V_{BAT}$  connects to  $V_{OUT}$  (through a 100 $\Omega$  switch) when  $V_{CC}$  is below  $V_{RST}$  and  $V_{BAT}$ . This is done to allow the back-up battery (e.g., a 3.6V lithium cell) to have a higher voltage than  $V_{CC}$ .

Assuming  $V_{BAT} > 2.0V$ , switchover at  $V_{SO}$  ensures that battery back-up mode is entered before  $V_{OUT}$  gets too close to the 2.0V minimum required to reliably retain data in most external SRAMs. When  $V_{CC}$  recovers, hysteresis is used to avoid oscillation around the  $V_{SO}$  point.  $V_{OUT}$  is connected to  $V_{CC}$  through a 3 $\Omega$  PMOS power switch.

**Note:** The back-up battery may be removed while  $V_{CC}$  is valid, assuming  $V_{BAT}$  is adequately decoupled (0.1 $\mu F$  typ), without danger of triggering a reset.

**Table 4. I/O Status in Battery Back-up**

Pin	Status
$V_{OUT}$	Connected to $V_{BAT}$ through internal switch
$V_{CC}$	Disconnected from $V_{OUT}$
PFI	Disabled
$\overline{PFO}$	Logic low
$\overline{E}$	High impedance
$\overline{E}_{CON}$	Logic high
WDI	Watchdog timer is disabled
$\overline{WDO}$	Logic low
$\overline{MR}$	Disabled
$\overline{RST}$	Logic low
RST	Logic high
$V_{BAT}$	Connected to $V_{OUT}$

### Chip-Enable Gating (STM818 only)

Internal gating of the chip enable ( $\overline{E}$ ) signal prevents erroneous data from corrupting the external CMOS RAM in the event of an undervoltage condition. The STM818 uses a series transmission gate from  $\overline{E}$  to  $\overline{E}_{CON}$  (see [Figure 12., page 11](#)). During normal operation (reset not asserted), the  $\overline{E}$  transmission gate is enabled and passes all  $\overline{E}$  transitions. When reset is asserted, this path becomes disabled, preventing erroneous data from corrupting the CMOS RAM. The short  $\overline{E}$  propagation delay from  $\overline{E}$  to  $\overline{E}_{CON}$  enables the STM818 to be used with most  $\mu P$ s. If  $\overline{E}$  is low when reset asserts,  $\overline{E}_{CON}$  remains low for typically 15 $\mu s$  to permit the current WRITE cycle to complete. Connect  $\overline{E}$  to  $V_{SS}$  if unused.

### Chip Enable Input (STM818 only)

The chip-enable transmission gate is disabled and  $\overline{E}$  is high impedance (disabled mode) while reset is asserted. During a power-down sequence when  $V_{CC}$  passes the reset threshold, the chip-enable transmission gate disables and  $\overline{E}$  immediately becomes high impedance if the voltage at  $\overline{E}$  is high. If  $\overline{E}$  is low when reset asserts, the chip-enable transmission gate will disable 15 $\mu s$  after reset asserts (see [Figure 13., page 11](#)). This permits the current WRITE cycle to complete during power-down.

Any time a reset is generated, the chip-enable transmission gate remains disabled and  $\overline{E}$  remains high impedance (regardless of  $\overline{E}$  activity) for the reset time-out period. When the chip enable transmission gate is enabled, the impedance of  $\overline{E}$  appears as a 40 $\Omega$  resistor in series with the load at  $\overline{E}_{CON}$ . The propagation delay through the chip-enable transmission gate depends on  $V_{CC}$ , the source impedance of the drive connected to  $\overline{E}$ , and the loading on  $\overline{E}_{CON}$ . The chip enable propagation delay is production tested from the 50% point on  $\overline{E}$  to the 50% point on  $\overline{E}_{CON}$  using a 50 $\Omega$  driver and a 50pF load capacitance (see [Figure 40., page 28](#)). For minimum propagation delay, minimize the capacitive load at  $\overline{E}_{CON}$  and use a low-output impedance driver.

### Chip Enable Output (STM818 only)

When the chip-enable transmission gate is enabled, the impedance of  $\overline{E}_{CON}$  is equivalent to a 40 $\Omega$  resistor in series with the source driving  $\overline{E}$ . In the disabled mode, the transmission gate is off and an active pull-up connects  $\overline{E}_{CON}$  to  $V_{OUT}$  (see [Figure 12., page 11](#)). This pull-up turns off when the transmission gate is enabled.

Figure 12. Chip-Enable Gating

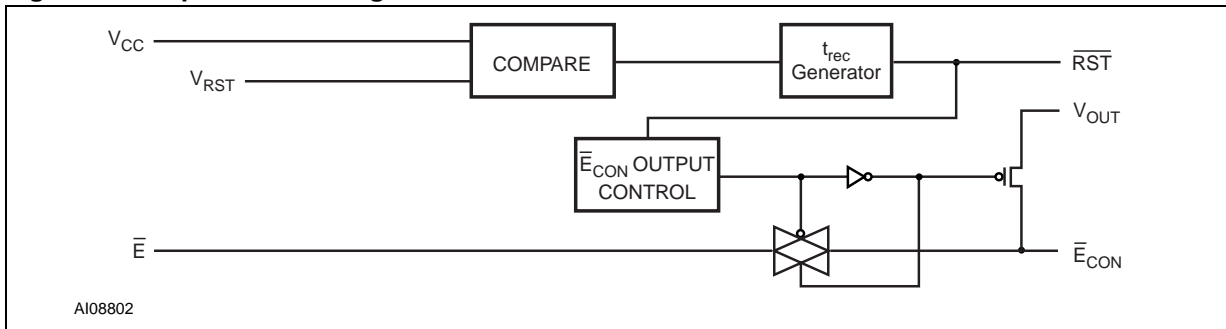
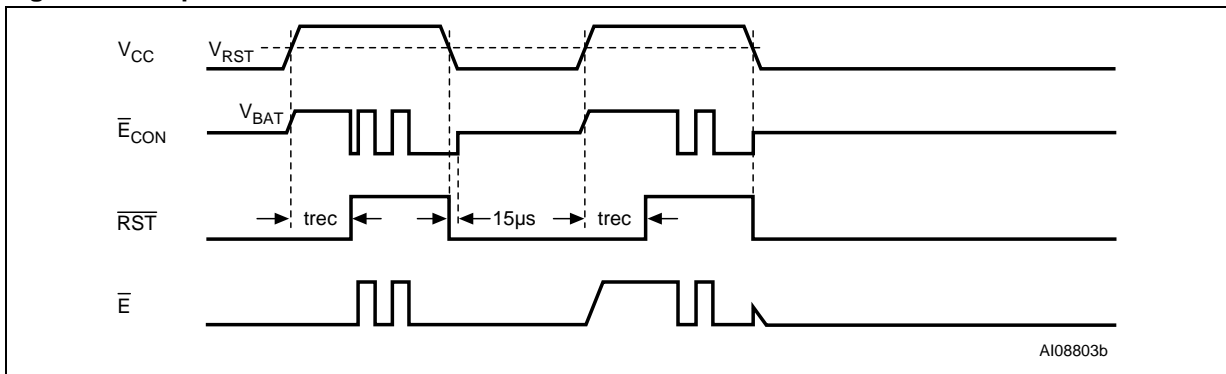


Figure 13. Chip Enable Waveform



**Power-fail Input/Output (NOT available on STM818)**

The Power-fail Input (PFI) is compared to an internal reference voltage (independent from the  $V_{RST}$  comparator). If PFI is less than the power-fail threshold ( $V_{PFI}$ ), the Power-Fail Output ( $\overline{PFO}$ ) will go low. This function is intended for use as an undervoltage detector to signal a failing power supply. Typically PFI is connected through an external voltage divider (see Figure 11., page 8) to either the unregulated DC input (if it is available) or the regulated output of the  $V_{CC}$  regulator. The voltage divider can be set up such that the voltage at PFI falls below  $V_{PFI}$  several milliseconds before the regulated  $V_{CC}$  input to the STM690A/692A/703/704/802/805/817/818/819 Supervisor or the microprocessor drops below the minimum operating voltage.

During battery back-up, the power-fail comparator turns off and  $\overline{PFO}$  goes (or remains) low (see Figure 14 and Figure 15., page 13). This occurs after  $V_{CC}$  drops below 2.4V (or  $V_{SO}$ ). When power returns,  $\overline{PFO}$  is forced high (STM817/819 only), irrespective of  $V_{PFI}$  for the WRITE protect time ( $t_{rec}$ ). At the end of this time, the power-fail comparator is enabled and  $\overline{PFO}$  follows PFI. If the comparator is unused, PFI should be connected to  $V_{SS}$  and  $\overline{PFO}$  left unconnected.  $\overline{PFO}$  may be connected to  $\overline{MR}$  on the STM703/704/818 so that a low voltage on PFI will generate a reset output.

**Applications Information**

These Supervisor circuits are not short-circuit protected. Shorting  $V_{OUT}$  to ground - excluding power-up transients such as charging a decoupling capacitor - destroys the device. Decouple both  $V_{CC}$  and  $V_{BAT}$  pins to ground by placing 0.1 $\mu$ F capacitors as close to the device as possible.

**Figure 14. Power-fail Comparator Waveform (STM817/818/819)**

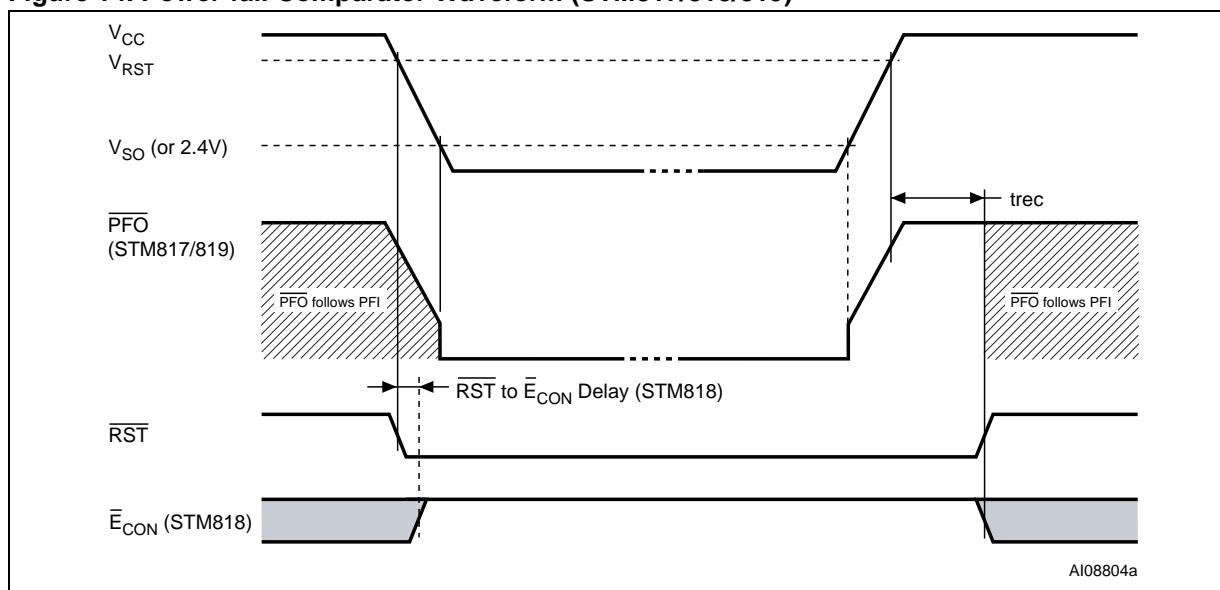
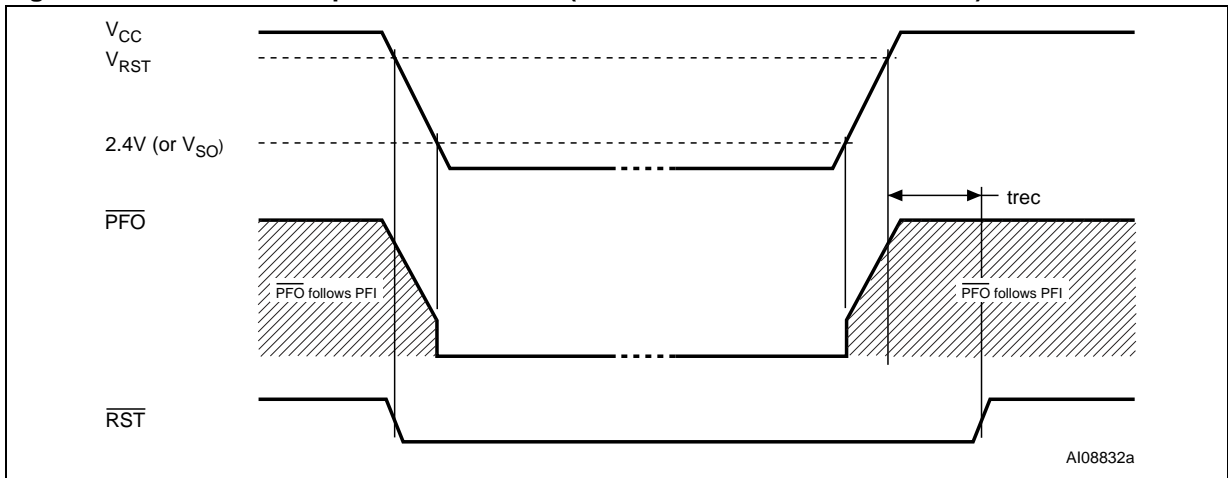


Figure 15. Power-fail Comparator Waveform (STM690A/692A/703/704/802/805)



**Using a SuperCap™ as a Backup Power Source**

SuperCaps™ are capacitors with extremely high capacitance values (e.g., order of 0.47F) for their size. Figure 16 shows how to use a SuperCap as a back-up power source. The SuperCap may be connected through a diode to the 5V input. Since V<sub>BAT</sub> can exceed V<sub>CC</sub> while V<sub>CC</sub> is above the reset threshold, there are no special precautions when using these supervisors with a SuperCap.

**Negative-Going V<sub>CC</sub> Transients**

The STM690A/692A/703/704/802/805/817/818/819 Supervisor are relatively immune to negative-going V<sub>CC</sub> transients (glitches). Figure 38., page 25 shows typical transient duration versus reset comparator overdrive (for which the STM690A/692A/703/704/802/805/817/818/819 will NOT generate a reset pulse). The graph was generated using a negative pulse applied to V<sub>CC</sub>, starting at V<sub>RST</sub> + 0.3V and ending below the reset threshold by the magnitude indicated (comparator overdrive). The graph indicates the maximum pulse width a negative V<sub>CC</sub> 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. Typically, a V<sub>CC</sub> transient that goes 100mV below the reset threshold and lasts 40µs or less will not cause a reset pulse. A 0.1µF bypass capacitor mounted as close as possible to the V<sub>CC</sub> pin provides additional transient immunity.

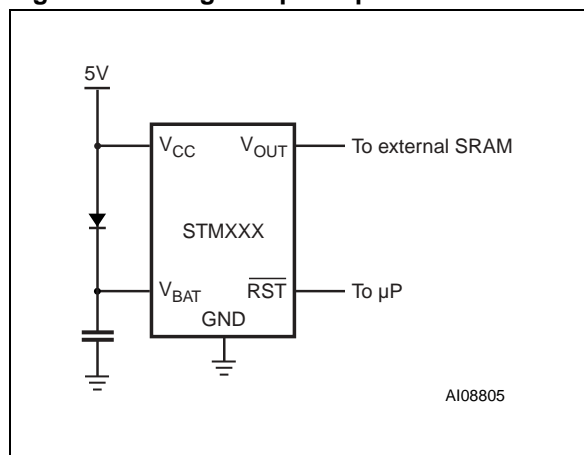
**Battery Freshness Seal (STM817/818/819)**

The battery freshness seal disconnects the back-up battery from internal circuitry and V<sub>OUT</sub> until it is needed. This allows an OEM to ensure that the back-up battery connected to V<sub>BAT</sub> will be fresh when the final product is put to use. To enable the freshness seal:

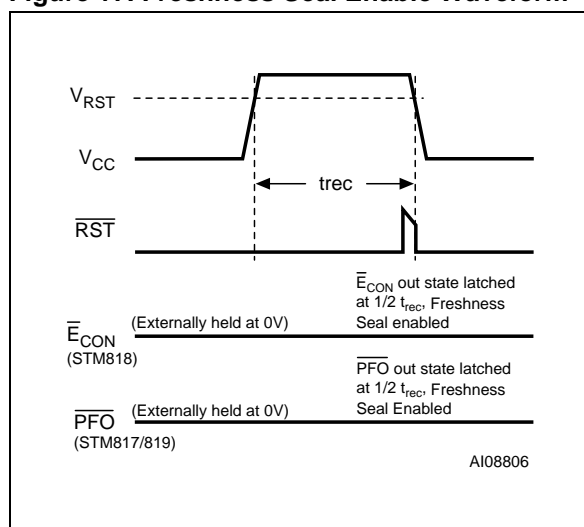
1. Connect a battery to V<sub>BAT</sub>;
2. Ground PFO;
3. Bring V<sub>CC</sub> above the reset threshold and hold it there until reset is deasserted following the reset timeout period; and
4. Bring V<sub>CC</sub> down again (Figure 17).

Use the same procedure for the STM818, but ground E<sub>CON</sub> instead of PFO. Once the battery freshness seal is enabled (disconnecting the back-up battery from internal circuitry and anything connected to V<sub>OUT</sub>), it remains enabled until V<sub>CC</sub> is brought above V<sub>RST</sub>.

**Figure 16. Using a SuperCap™**



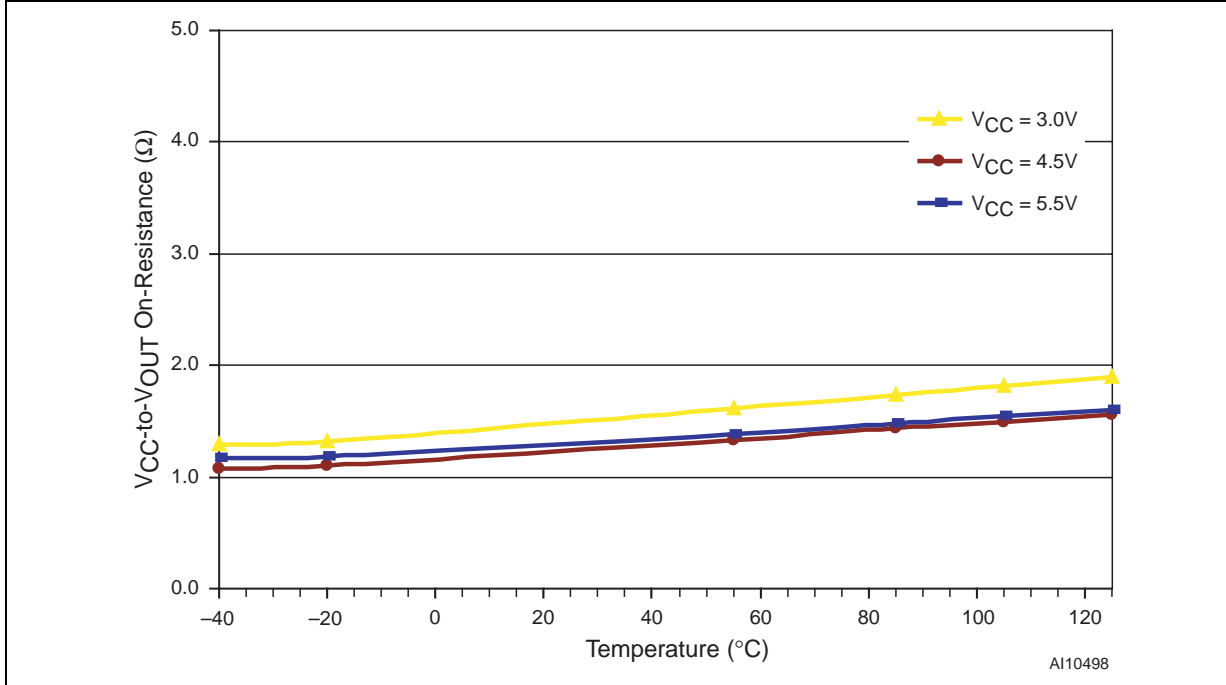
**Figure 17. Freshness Seal Enable Waveform**



**TYPICAL OPERATING CHARACTERISTICS**

Note: Typical values are at  $T_A = 25^\circ\text{C}$

**Figure 18.  $V_{CC}$ -to- $V_{OUT}$  On-Resistance vs. Temperature**



**Figure 19.  $V_{BAT}$ -to- $V_{OUT}$  On-Resistance vs. Temperature**

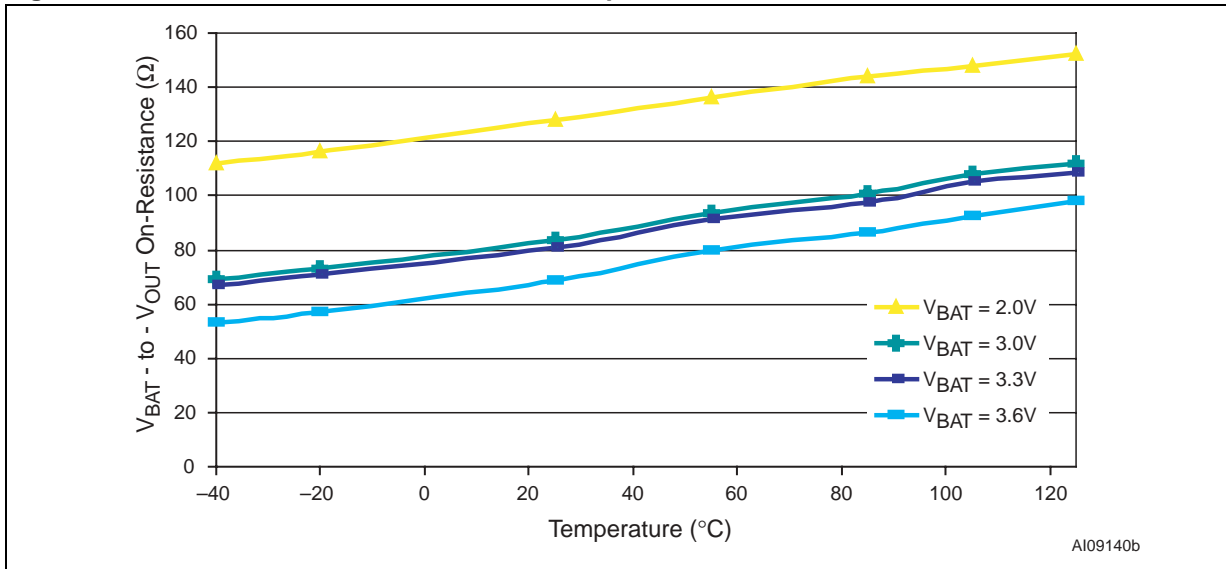


Figure 20. Supply Current vs. Temperature (no load)

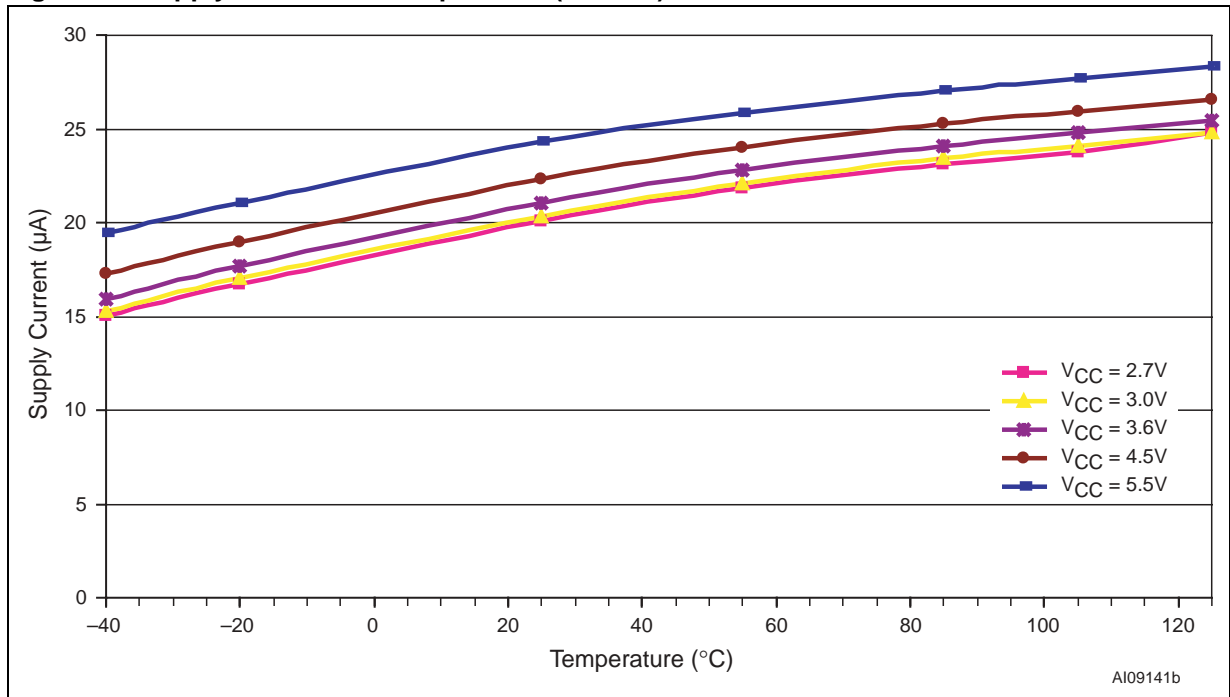


Figure 21. Battery Current vs. Temperature

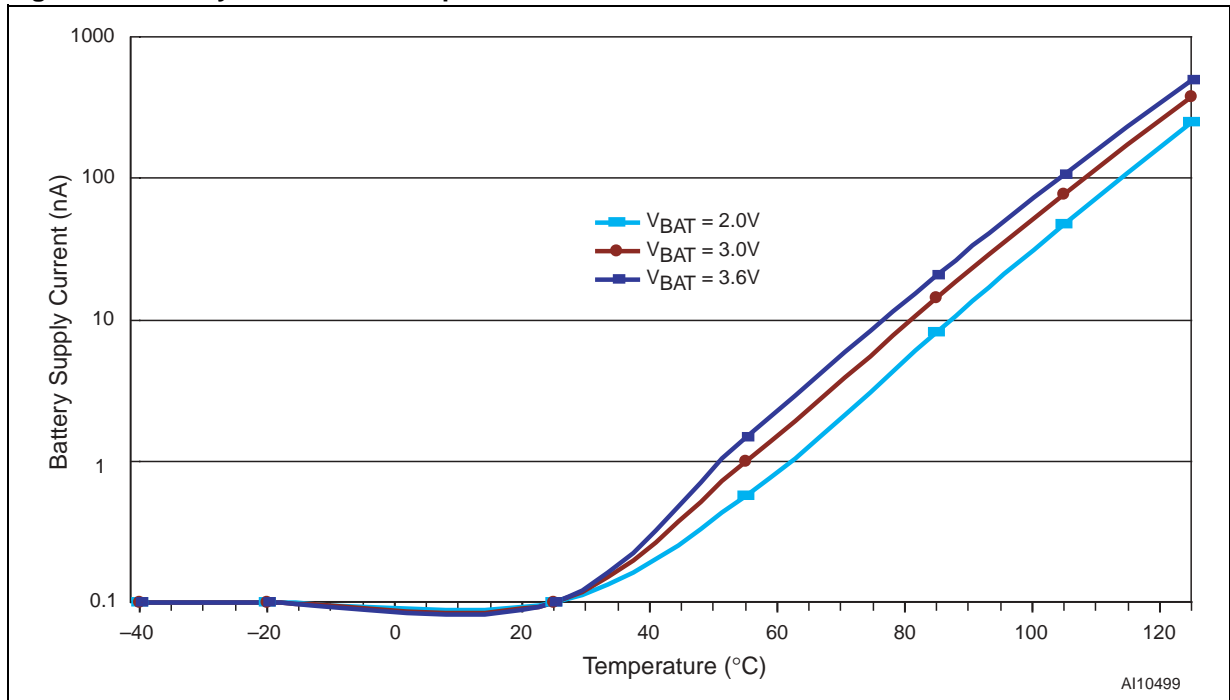




Figure 22. V<sub>PFI</sub> Threshold vs. Temperature

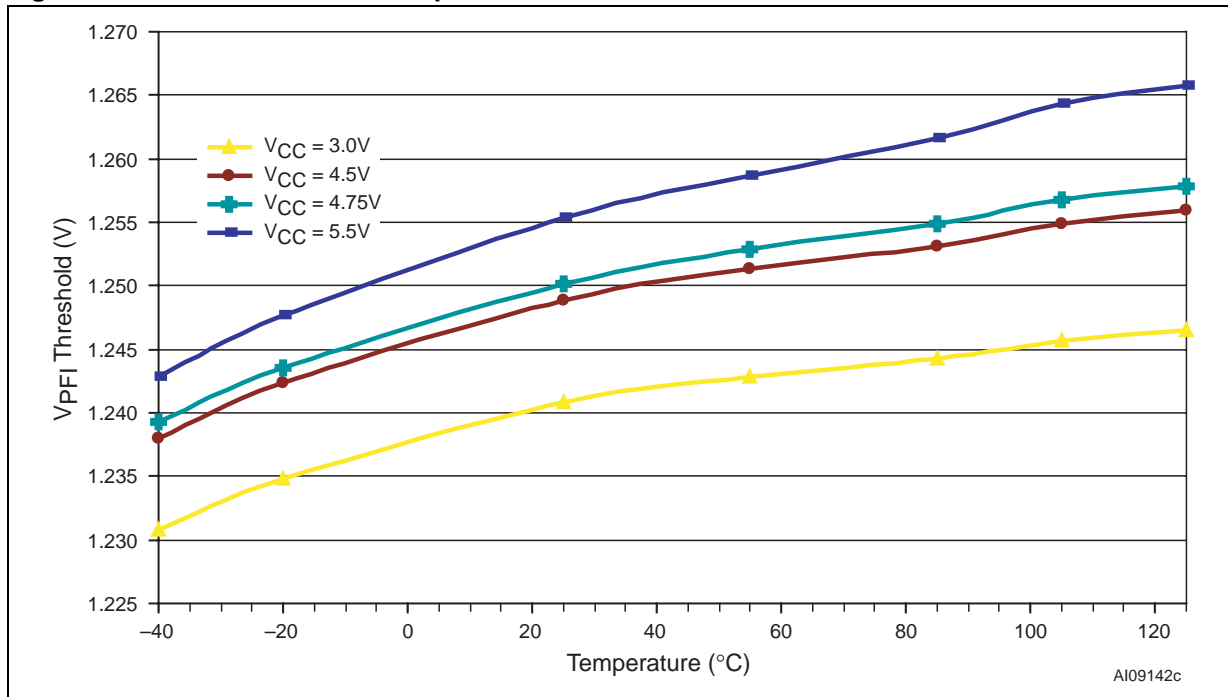


Figure 23. Reset Comparator Propagation Delay vs. Temperature (Other than STM817/818/819)

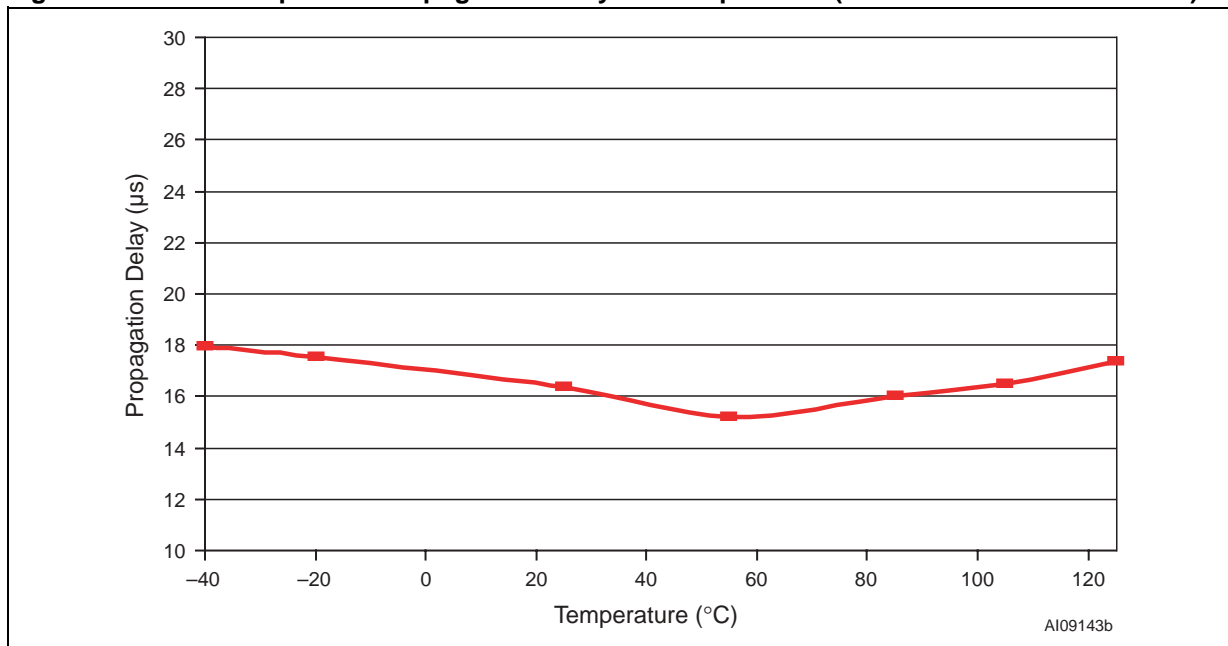


Figure 24. Reset Comparator Propagation Delay vs. Temperature ( $V_{BAT}=3.0V$ ; STM817/818/819)

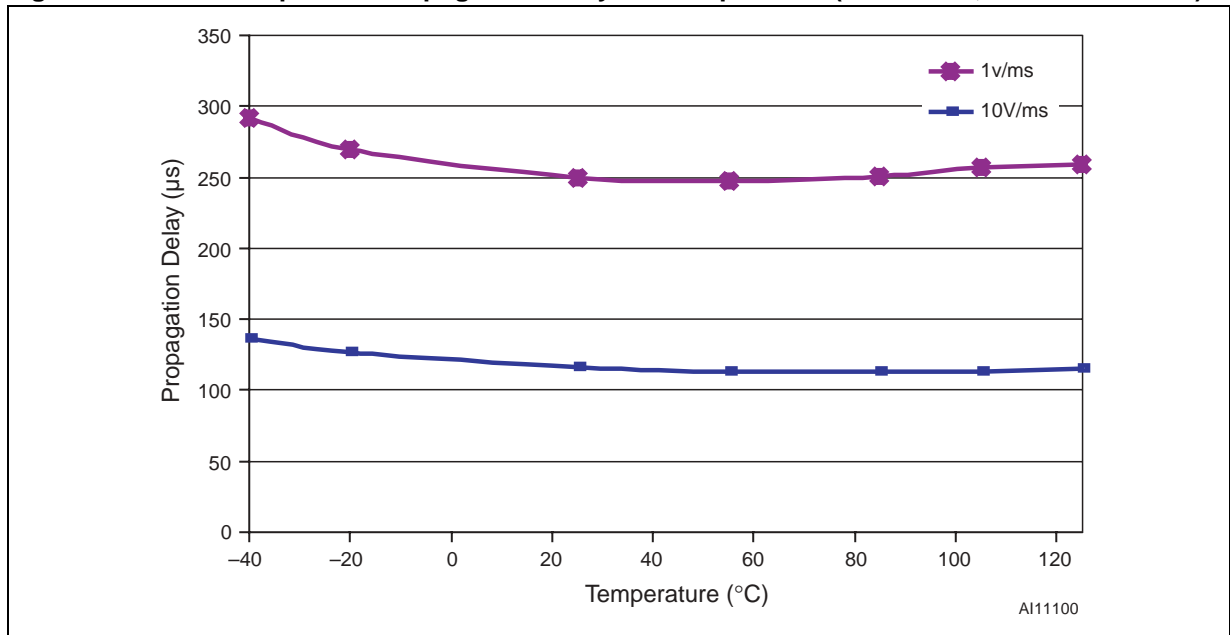


Figure 25. Power-up  $t_{rec}$  vs. Temperature

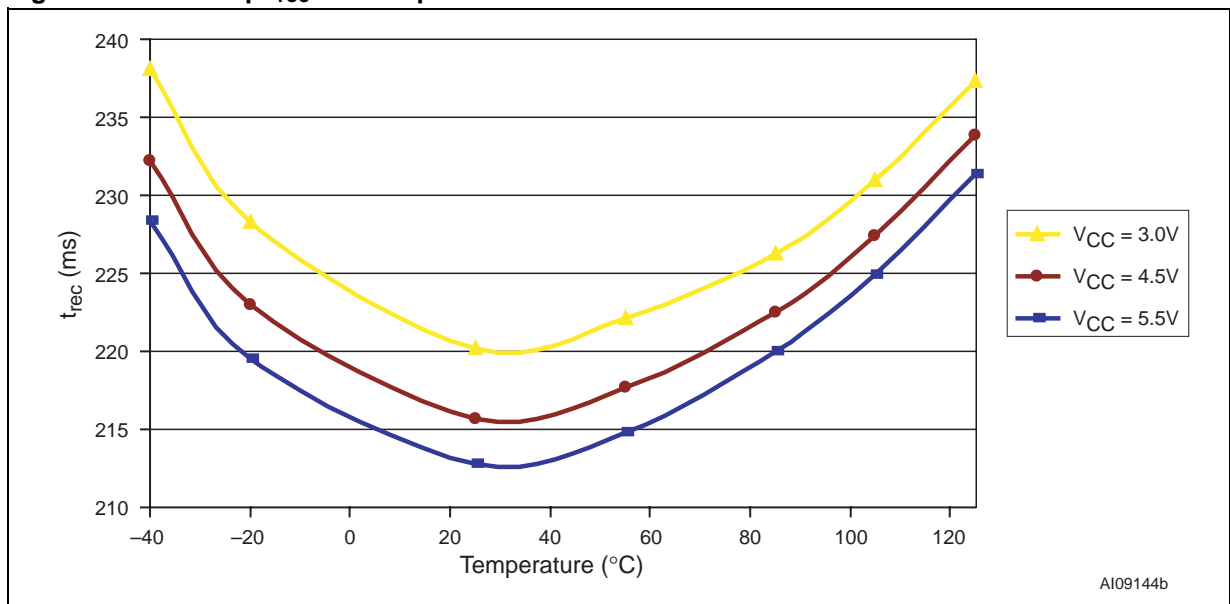


Figure 26. Normalized Reset Threshold vs. Temperature

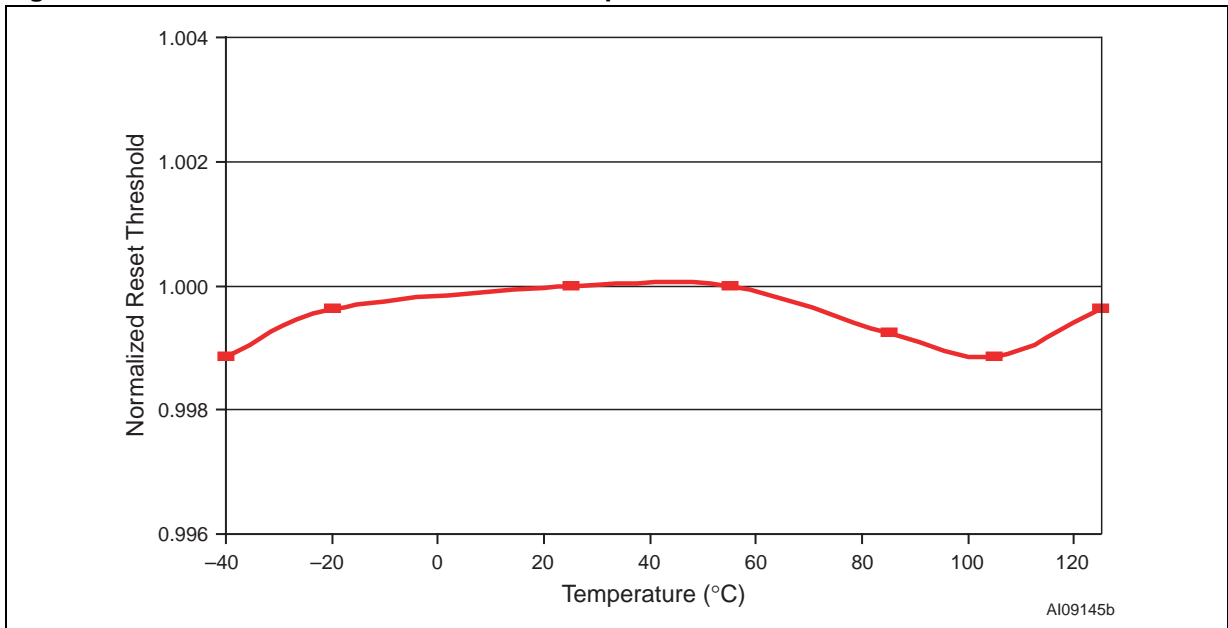


Figure 27. Watchdog Time-out Period vs. Temperature

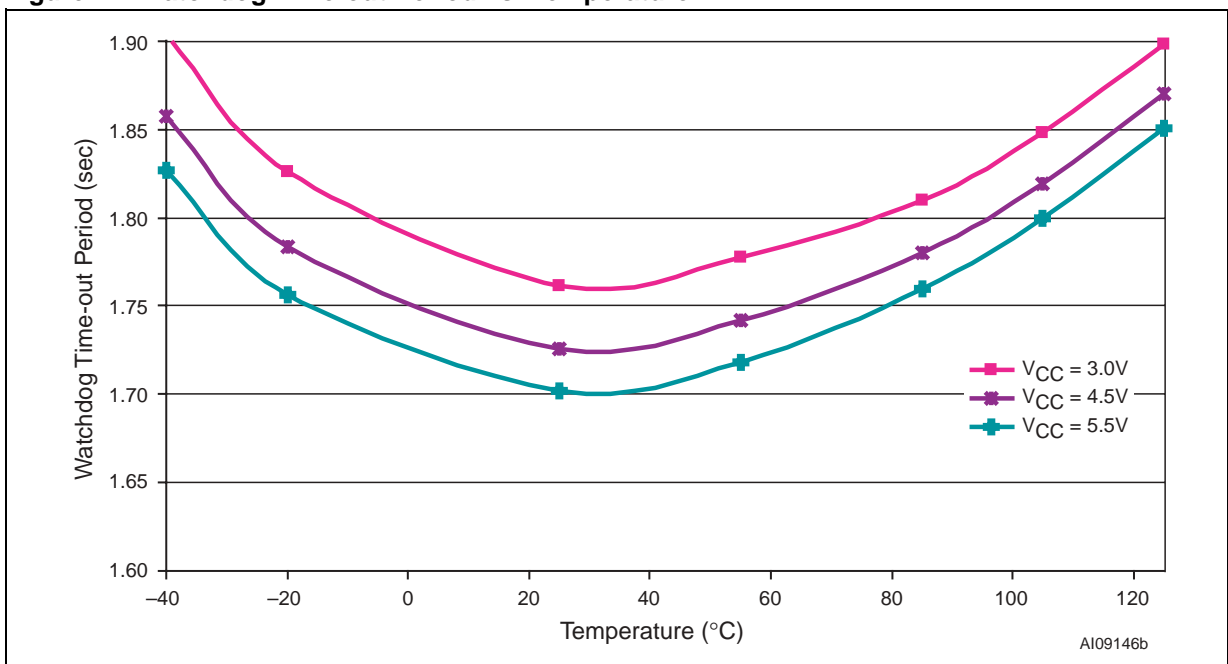


Figure 28.  $\bar{E}$  to  $\bar{E}_{CON}$  On-Resistance vs. Temperature

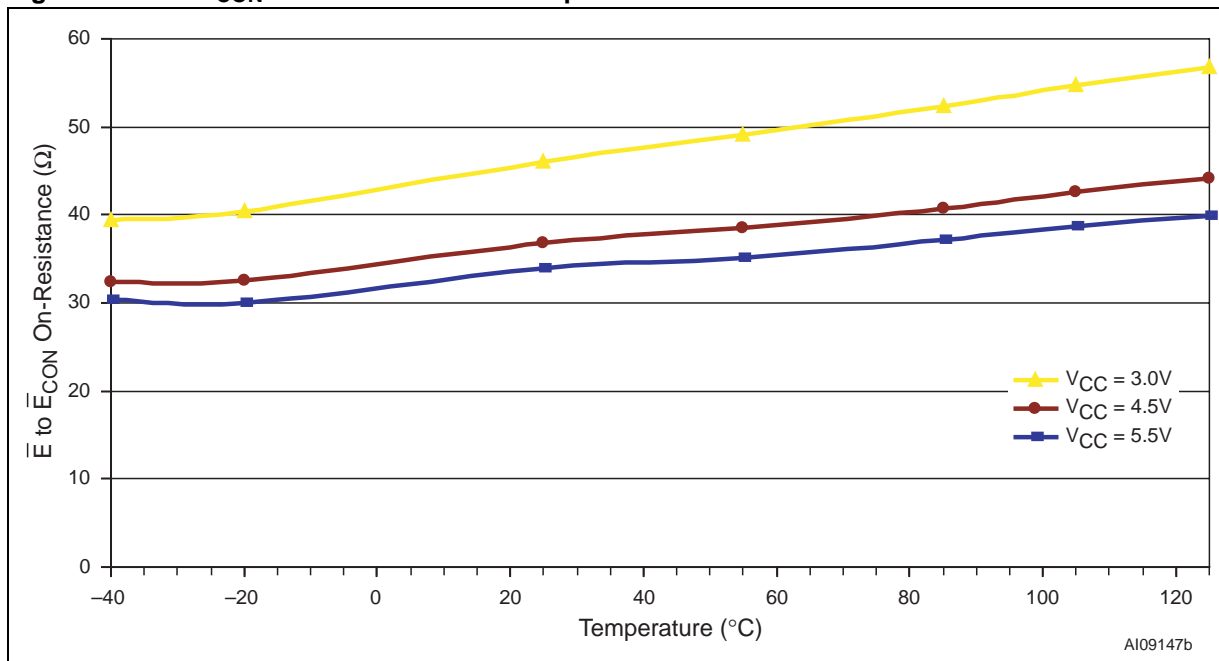


Figure 29. PFI to  $\overline{PFO}$  Propagation Delay vs. Temperature

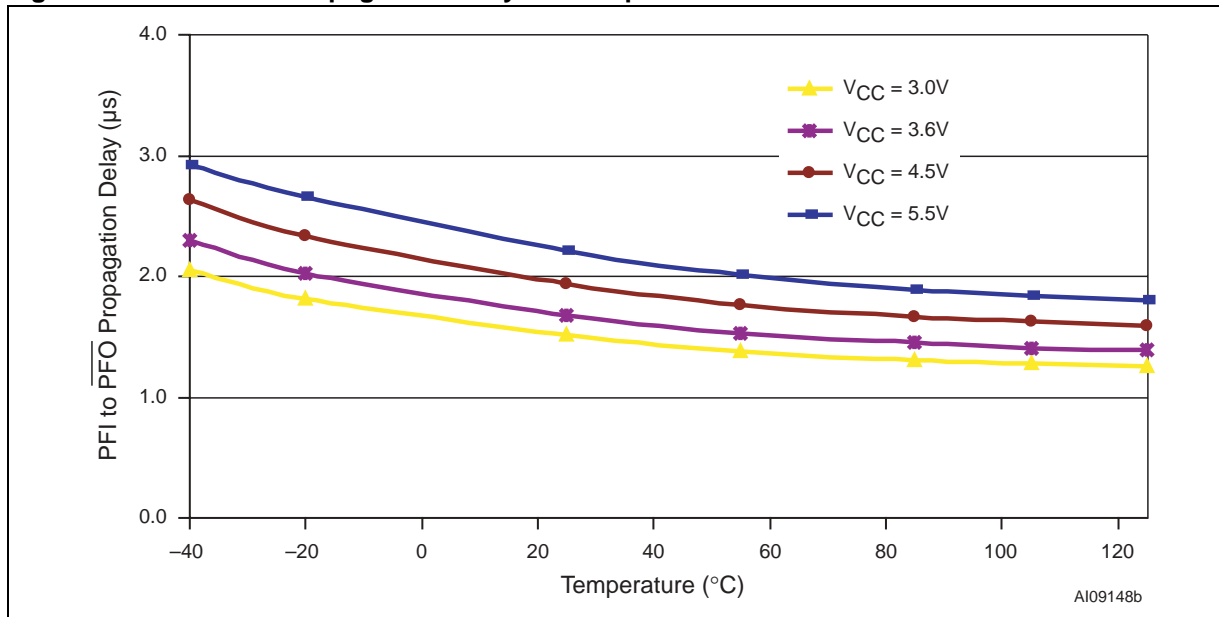


Figure 30. Output Voltage vs. Load Current ( $V_{CC} = 5V$ ;  $V_{BAT} = 2.8V$ ;  $T_A = 25^\circ C$ )

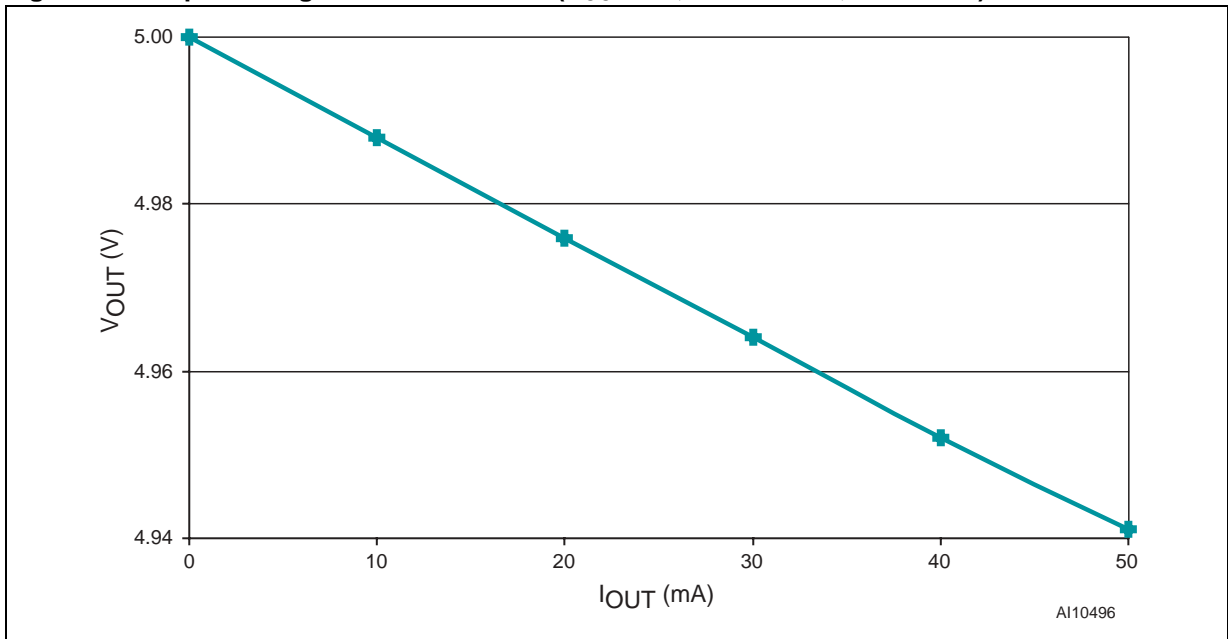


Figure 31. Output Voltage vs. Load Current ( $V_{CC} = 0V$ ;  $V_{BAT} = 2.8V$ ;  $T_A = 25^\circ C$ )

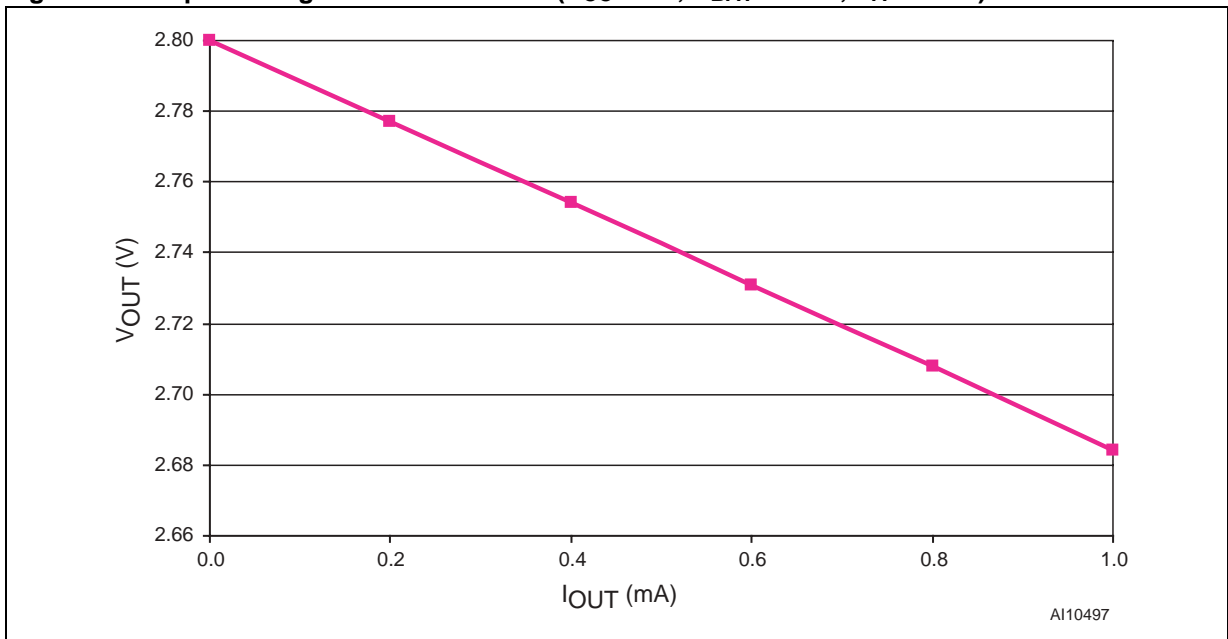


Figure 32.  $\overline{\text{RST}}$  Output Voltage vs. Supply Voltage

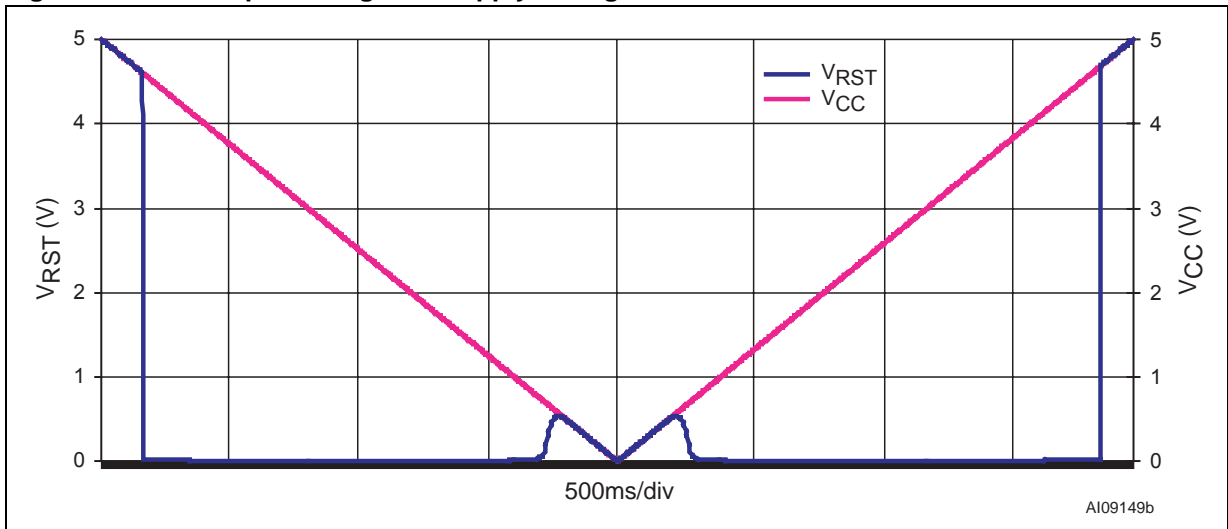


Figure 33.  $\overline{\text{RST}}$  Output Voltage vs. Supply Voltage

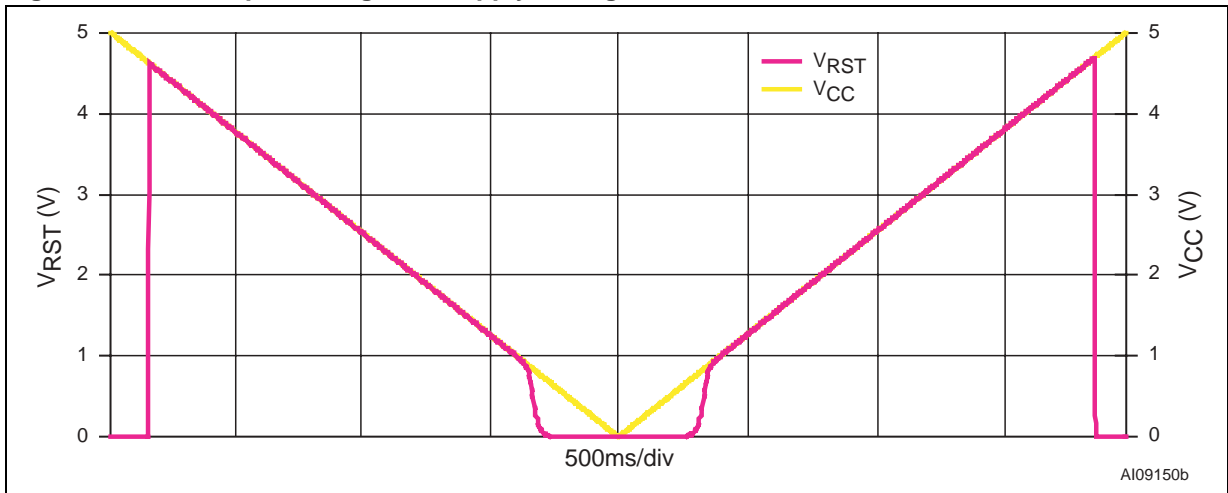


Figure 34.  $\overline{\text{RST}}$  Response Time (Assertion)

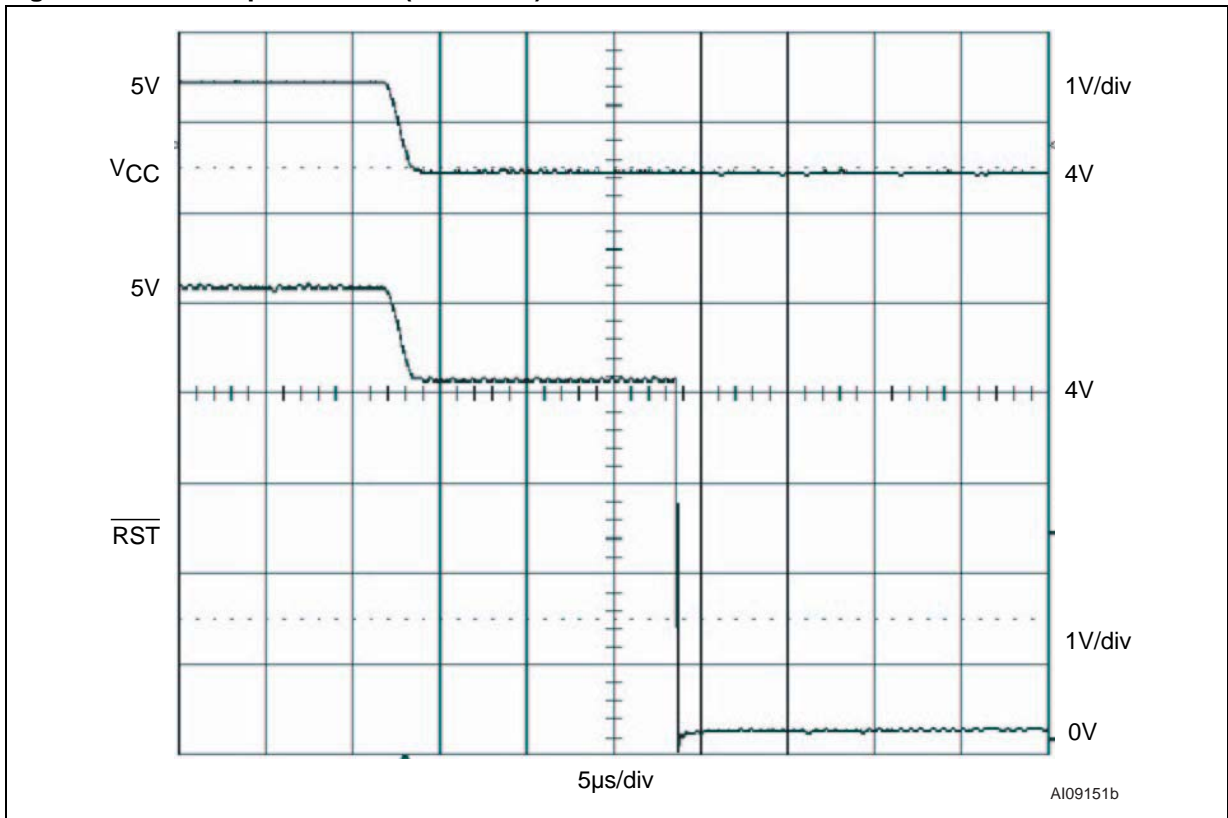


Figure 35. RST Response Time (Assertion)

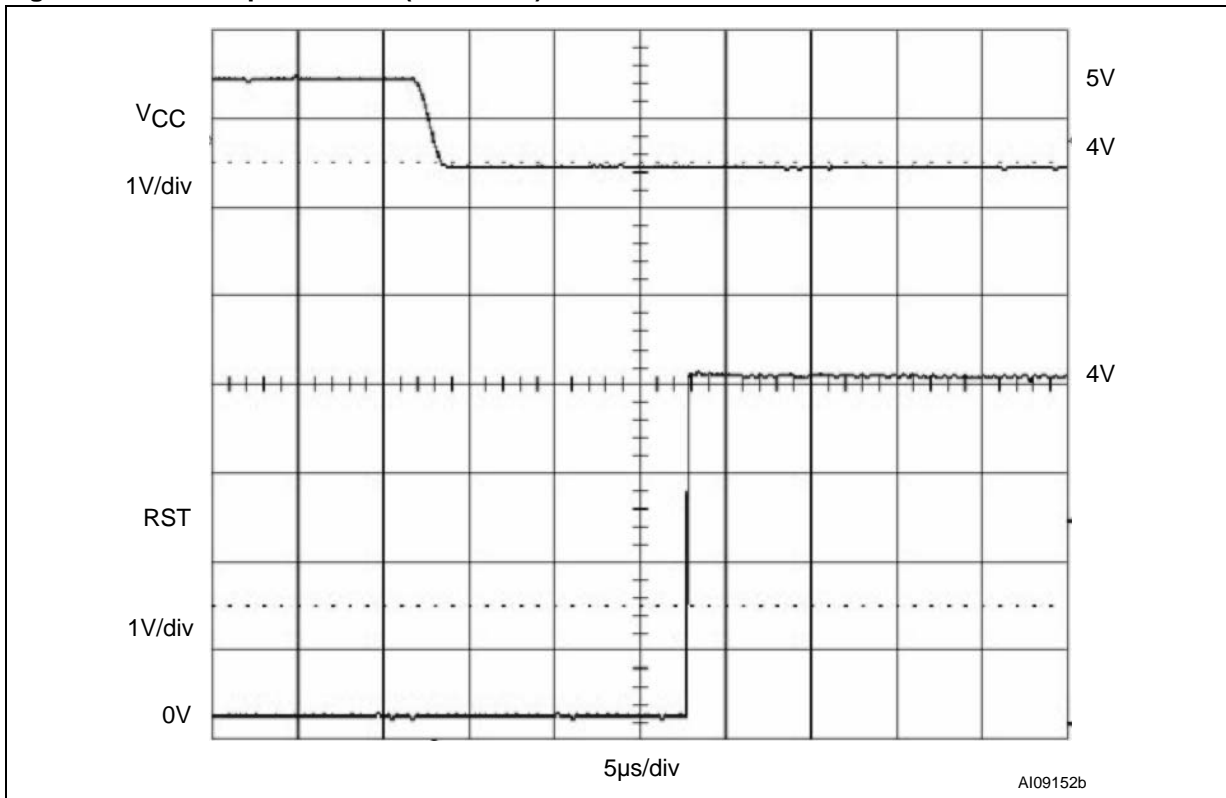


Figure 36. Power-fail Comparator Response Time (Assertion)

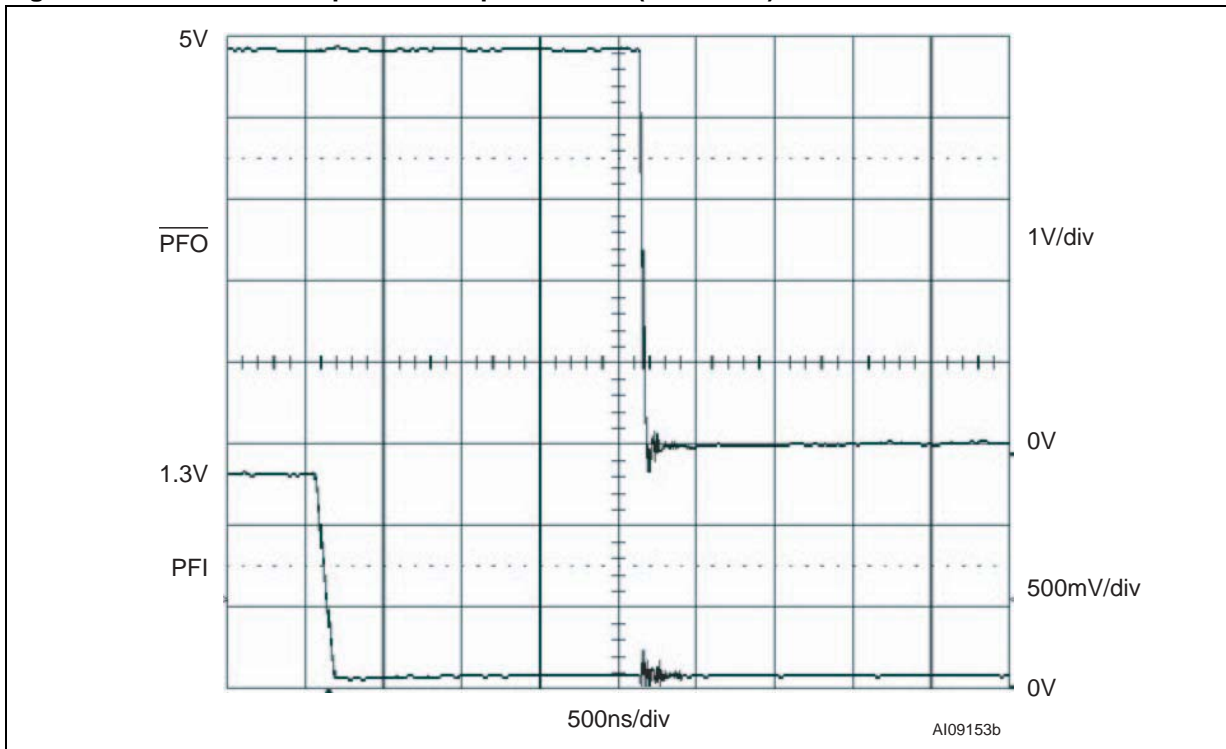




Figure 37. Power-fail Comparator Response Time (De-Assertion)

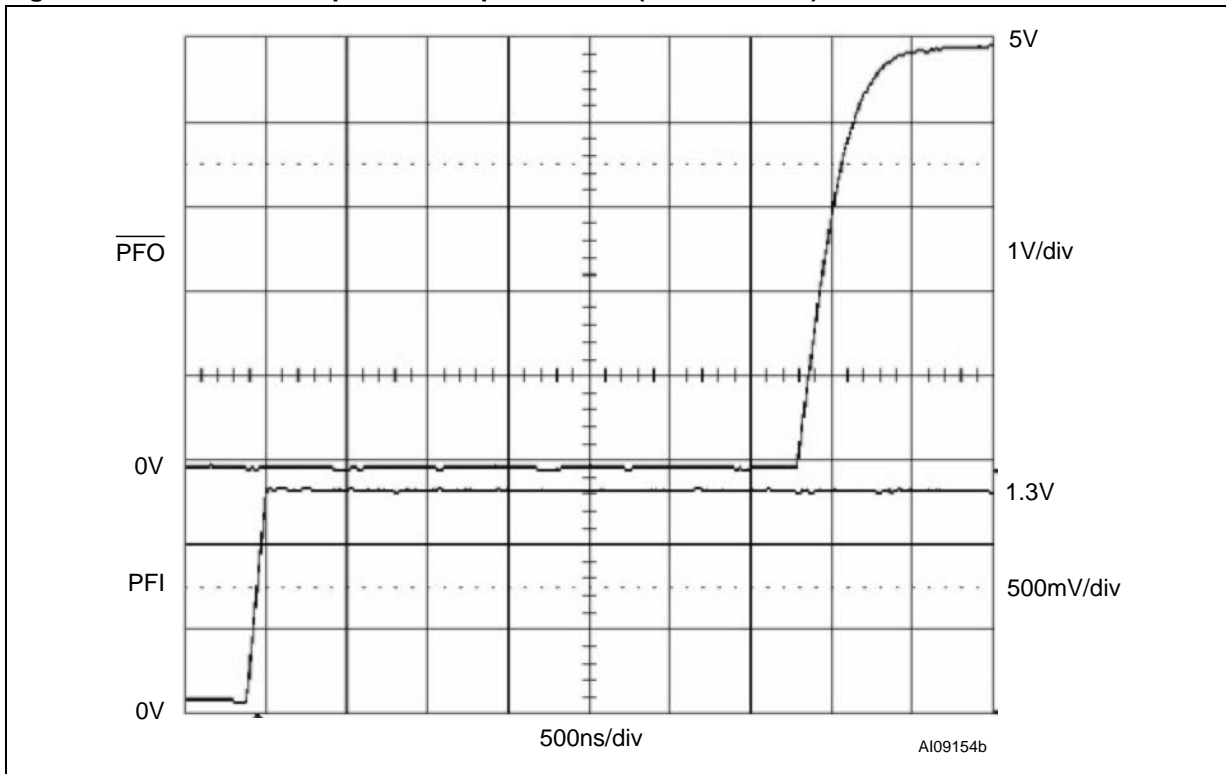


Figure 38. Maximum Transient Duration vs. Reset Threshold Overdrive

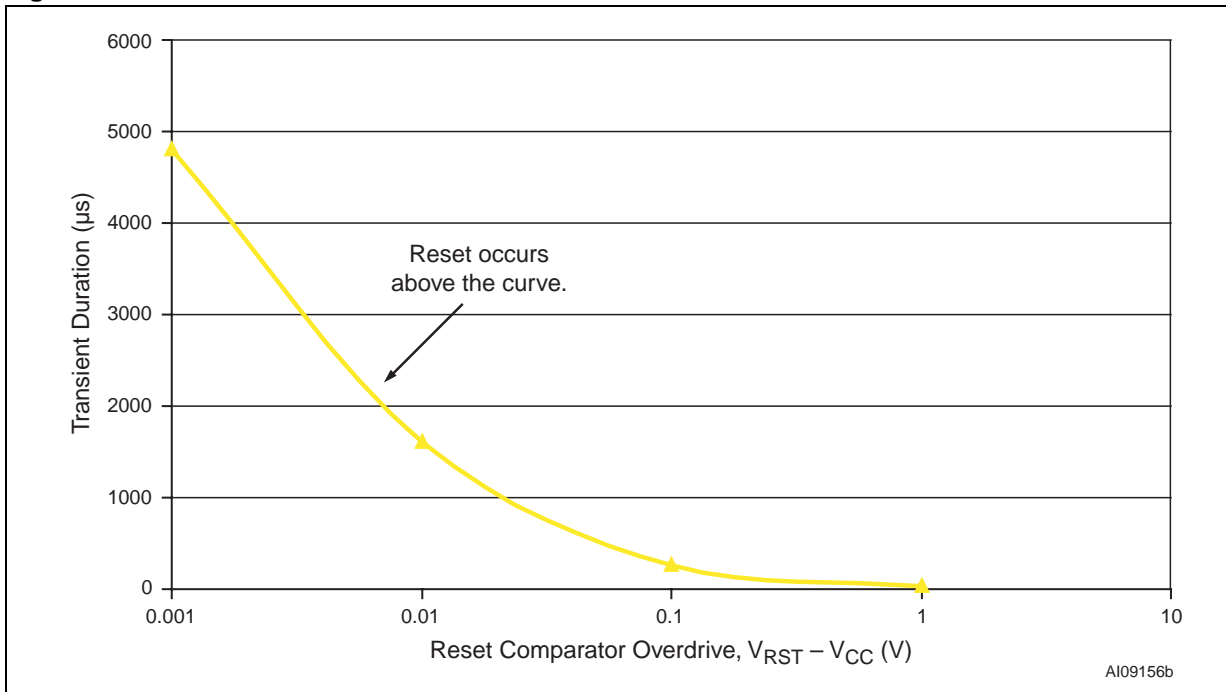
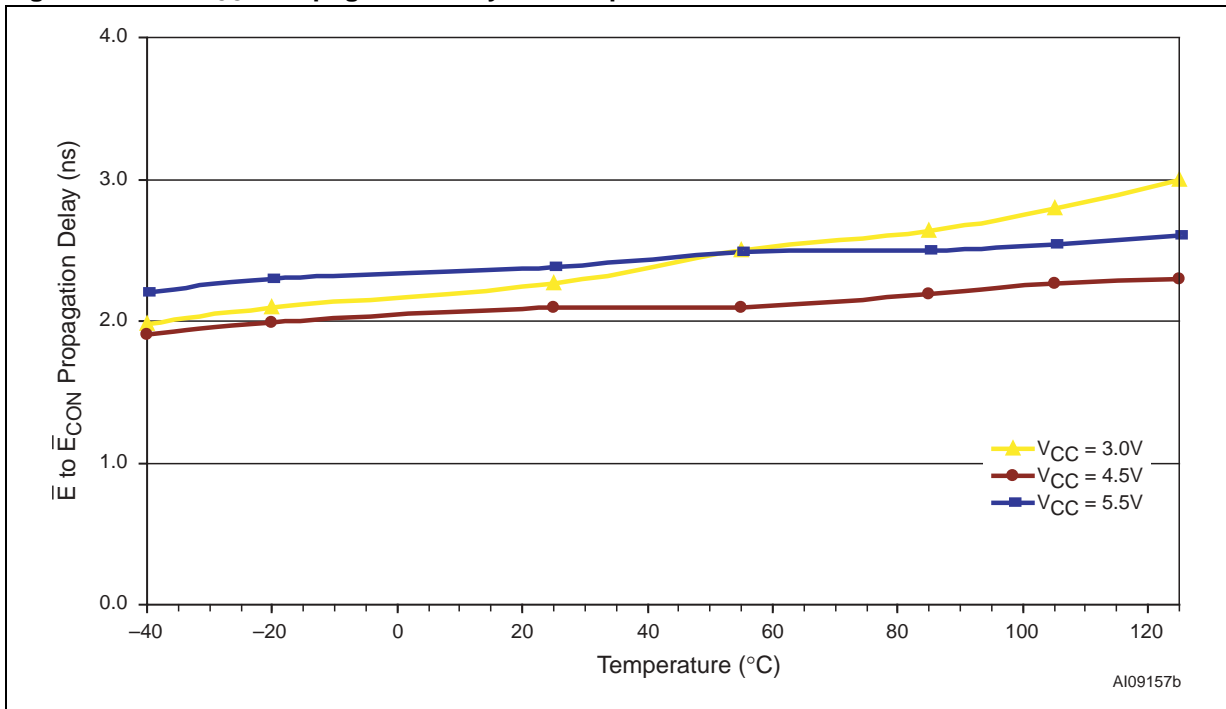


Figure 39.  $\bar{E}$  to  $\bar{E}_{CON}$  Propagation Delay vs. Temperature



## MAXIMUM RATING

Stressing the device above the rating listed in the Absolute Maximum Ratings table 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 im-

plied. 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 5. 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 V <sub>CC</sub> +0.3	V
V <sub>CC</sub> /V <sub>BAT</sub>	Supply Voltage	-0.3 to 6.0	V
I <sub>O</sub>	Output Current	20	mA
P <sub>D</sub>	Power Dissipation	320	mW

Note: 1. Reflow at peak temperature of 255°C to 260°C for < 30 seconds (total thermal budget not to exceed 180°C for between 90 to 150 seconds).

## DC AND AC PARAMETERS

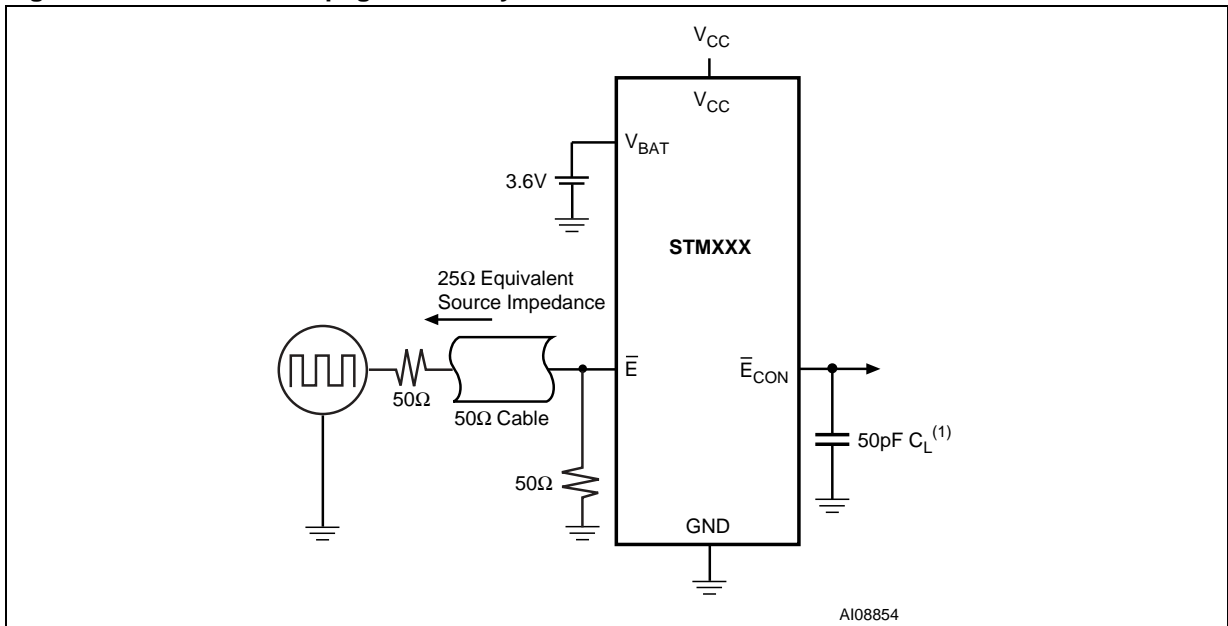
This section summarizes the operating measurement conditions, and the DC and AC characteristics of the device. The parameters in the DC and AC characteristics Tables that follow, are derived from tests performed under the Measurement

Conditions summarized in Table 6, 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 6. Operating and AC Measurement Conditions**

Parameter	STM690A/692A/703/704/802/805/817/818/819	Unit
V <sub>CC</sub> /V <sub>BAT</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 0.8V <sub>CC</sub>	V
Input and Output Timing Ref. Voltages	0.3 to 0.7V <sub>CC</sub>	V

Figure 40.  $\bar{E}$  to  $\bar{E}_{CON}$  Propagation Delay Test Circuit



Note: 1.  $C_L$  includes load capacitance and scope probe capacitance.

Figure 41. AC Testing Input/Output Waveforms

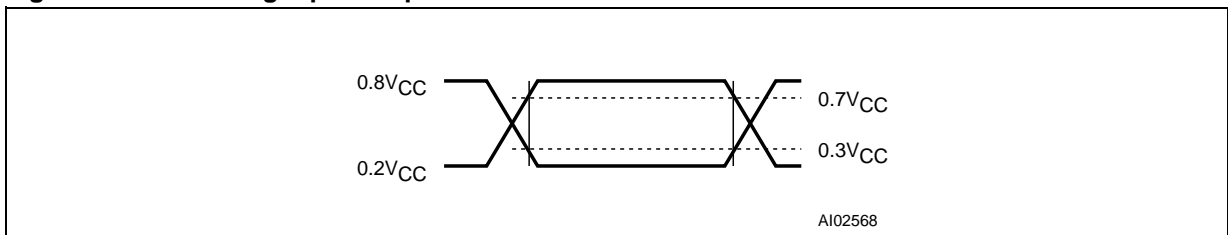
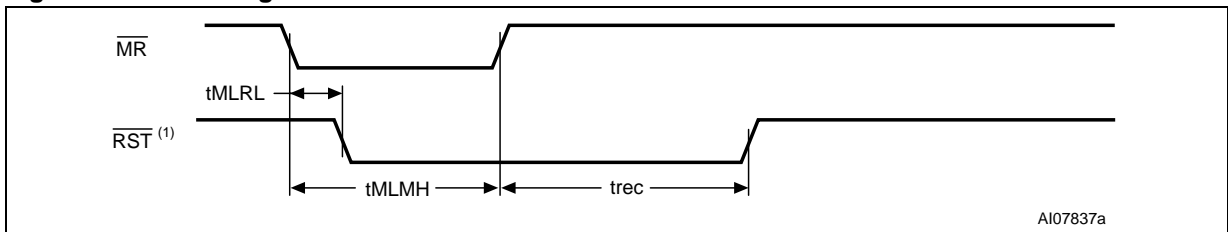


Figure 42.  $\overline{MR}$  Timing Waveform



Note: 1. RST for STM805.

Figure 43. Watchdog Timing

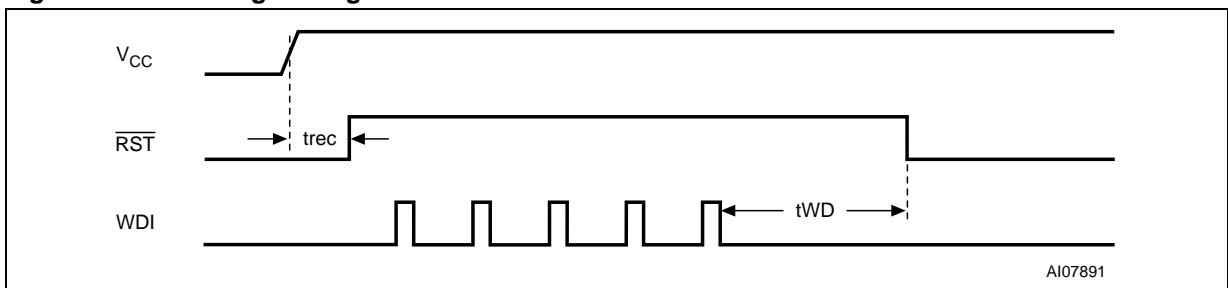


Table 7. DC and AC Characteristics

Sym	Alter-native	Description	Test Condition <sup>(1)</sup>	Min	Typ	Max	Unit	
V <sub>CC</sub> , V <sub>BAT</sub> <sup>(2)</sup>		Operating Voltage	T <sub>A</sub> = -40 to +85°C	1.2 <sup>(3)</sup>		5.5	V	
I <sub>CC</sub>		V <sub>CC</sub> Supply Current	Excluding I <sub>OUT</sub> (V <sub>CC</sub> < 5.5V)		25	60	μA	
		V <sub>CC</sub> Supply Current in Battery Back-up Mode	Excluding I <sub>OUT</sub> (V <sub>BAT</sub> = 2.3V, V <sub>CC</sub> = 2.0V, MR = V <sub>CC</sub> )		25	35	μA	
I <sub>BAT</sub> <sup>(4)</sup>		V <sub>BAT</sub> Supply Current in Battery Back-up Mode	Excluding I <sub>OUT</sub> (V <sub>BAT</sub> = 3.6V)		0.4	1.0	μA	
V <sub>OUT1</sub>		V <sub>OUT</sub> Voltage (Active)	I <sub>OUT1</sub> = 5mA <sup>(5)</sup>	V <sub>CC</sub> - 0.03	V <sub>CC</sub> - 0.015		V	
			I <sub>OUT1</sub> = 75mA	V <sub>CC</sub> - 0.3	V <sub>CC</sub> - 0.15		V	
			I <sub>OUT1</sub> = 250μA, V <sub>CC</sub> > 2.5V <sup>(5)</sup>	V <sub>CC</sub> - 0.0015	V <sub>CC</sub> - 0.0006		V	
V <sub>OUT2</sub>		V <sub>OUT</sub> Voltage (Battery Back-up)	I <sub>OUT2</sub> = 250μA, V <sub>BAT</sub> = 2.3V	V <sub>BAT</sub> - 0.1	V <sub>BAT</sub> - 0.034		V	
			I <sub>OUT2</sub> = 1mA, V <sub>BAT</sub> = 2.3V		V <sub>BAT</sub> - 0.14		V	
V <sub>CC</sub> to V <sub>OUT</sub> On-resistance					3	4	Ω	
V <sub>BAT</sub> to V <sub>OUT</sub> On-resistance					100		Ω	
I <sub>LI</sub>		Input Leakage Current ( $\overline{\text{MR}}$ )	4.5V < V <sub>CC</sub> < 5.5V	75	125	300	μA	
		Input Leakage Current (PFI)	0V = V <sub>IN</sub> = V <sub>CC</sub>	-25	2	+25	nA	
		Input Leakage Current (WDI) <sup>(6)</sup>	WDI = V <sub>CC</sub> , time average		120	160		μA
			WDI = GND, time average		-20	-15		μA
V <sub>IH</sub>		Input High Voltage ( $\overline{\text{MR}}$ )	4.5V < V <sub>CC</sub> < 5.5V	2.0			V	
V <sub>IH</sub>		Input High Voltage (WDI)	V <sub>RST</sub> (max) < V <sub>CC</sub> < 5.5V	0.7V <sub>CC</sub>			V	
V <sub>IL</sub>		Input Low Voltage ( $\overline{\text{MR}}$ )	4.5V < V <sub>CC</sub> < 5.5V			0.8	V	
V <sub>IL</sub>		Input Low Voltage (WDI)	V <sub>RST</sub> (max) < V <sub>CC</sub> < 5.5V			0.3V <sub>CC</sub>	V	
V <sub>OL</sub>		Output Low Voltage ( $\overline{\text{PFO}}$ , $\overline{\text{RST}}$ , RST)	V <sub>CC</sub> = V <sub>RST</sub> (max), I <sub>SINK</sub> = 3.2mA			0.3	V	
		Output Low Voltage ( $\overline{\text{ECON}}$ )	V <sub>CC</sub> = V <sub>RST</sub> (max), I <sub>OUT</sub> = 1.6mA, E = 0V			0.2V <sub>CC</sub>	V	
V <sub>OL</sub>		Output Low Voltage ( $\overline{\text{RST}}$ )	I <sub>SINK</sub> = 50μA, V <sub>CC</sub> = 1.0V, V <sub>BAT</sub> = V <sub>CC</sub> , T <sub>A</sub> = 0°C to 85°C			0.3	V	
			I <sub>SINK</sub> = 100μA, V <sub>CC</sub> = 1.2V, V <sub>BAT</sub> = V <sub>CC</sub>			0.3	V	

**STM690A/692A/703/704/802/805/817/818/819**

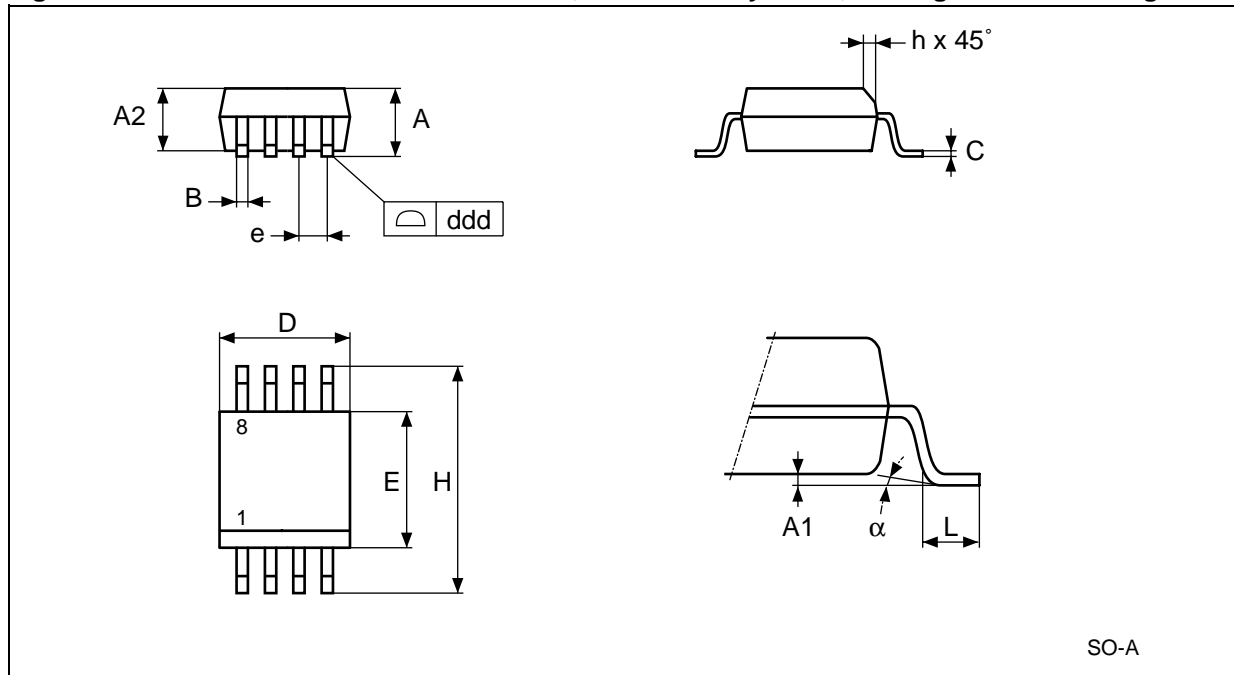
Sym	Alternative	Description	Test Condition <sup>(1)</sup>	Min	Typ	Max	Unit	
V <sub>OH</sub>		Output High Voltage ( $\overline{\text{RST}}$ , RST)	I <sub>SOURCE</sub> = 1 mA, V <sub>CC</sub> = V <sub>RST</sub> (max)	2.4			V	
		Output High Voltage ( $\overline{\text{ECON}}$ )	V <sub>CC</sub> = V <sub>RST</sub> (max), I <sub>OUT</sub> = 1.6 mA, $\overline{\text{E}} = \text{VCC}$	0.8V <sub>CC</sub>			V	
		Output High Voltage ( $\overline{\text{PFO}}$ )	I <sub>SOURCE</sub> = 75 μA, V <sub>CC</sub> = V <sub>RST</sub> (max)	0.8V <sub>CC</sub>			V	
V <sub>OH</sub>		Output High Voltage	I <sub>SOURCE</sub> = 4 μA, V <sub>CC</sub> = 1.1 V, V <sub>BAT</sub> = V <sub>CC</sub> , T <sub>A</sub> = 0°C to 85°C			0.8	V	
			I <sub>SOURCE</sub> = 4 μA, V <sub>CC</sub> = 1.2 V, V <sub>BAT</sub> = V <sub>CC</sub>			0.9	V	
V <sub>OHB</sub>		V <sub>OH</sub> Battery Back-up ( $\overline{\text{RST}}$ , RST)	I <sub>SOURCE</sub> = 100 μA, V <sub>CC</sub> = 0, V <sub>BAT</sub> = 2.8 V	0.8V <sub>BAT</sub>			V	
		V <sub>OH</sub> Battery Back-up ( $\overline{\text{ECON}}$ )	I <sub>SOURCE</sub> = 75 μA, V <sub>CC</sub> = 0, V <sub>BAT</sub> = 2.8 V	0.8V <sub>BAT</sub>			V	
<b>Power-fail Comparator (NOT available on STM818)</b>								
V <sub>PFI</sub>		PFI Input Threshold	PFI Falling (V <sub>CC</sub> = 5 V)	All other versions	1.20	1.25	1.30	V
				STM802	1.225	1.250	1.275	V
t <sub>PF</sub>		PFI to $\overline{\text{PFO}}$ Propagation Delay			2		μs	
I <sub>SC</sub>		$\overline{\text{PFO}}$ Output Short to GND Current	V <sub>CC</sub> = 5 V, V <sub>PFO</sub> = 0 V	0.1	0.75	2.0	mA	
<b>Battery Switchover</b>								
V <sub>SO</sub>		Battery Back-up Switchover Voltage <sup>(7,8)</sup> (V <sub>CC</sub> < V <sub>BAT</sub> & V <sub>CC</sub> < V <sub>RST</sub> )	Power-down	V <sub>RST</sub> > V <sub>BAT</sub>		V <sub>BAT</sub>		V
				V <sub>RST</sub> < V <sub>BAT</sub>		V <sub>RST</sub>		V
			Power-up	V <sub>RST</sub> > V <sub>BAT</sub>		V <sub>BAT</sub>		V
				V <sub>RST</sub> < V <sub>BAT</sub>		V <sub>RST</sub>		V
		Hysteresis				40		mV
<b>Reset Thresholds</b>								
V <sub>RST</sub>		Reset Threshold <sup>(9)</sup>	STM690A/703, STM8XXL	4.50	4.65	4.75	V	
			STM692A/704, STM8XXM	4.25	4.40	4.50	V	
		Reset Threshold Hysteresis			25		mV	
		V <sub>CC</sub> to $\overline{\text{RST}}$ Delay (from V <sub>RST</sub> , V <sub>CC</sub> falling at 10 V/ms)	STM817/818/819		100		μs	
t <sub>rec</sub>		$\overline{\text{RST}}$ Pulse Width		140	200	280	ms	

Sym	Alter-native	Description	Test Condition <sup>(1)</sup>	Min	Typ	Max	Unit
<b>Push-button Reset Input (STM703/704/819)</b>							
t <sub>MLMH</sub>	t <sub>MR</sub>	MR Pulse Width	STM703/704	150			ns
			STM819	1			μs
t <sub>MLRL</sub>	t <sub>MRD</sub>	MR to RST Output Delay	STM703/704			250	ns
			STM819		120		ns
		MR Glitch Immunity	STM819		100		ns
		MR Pull-up Resistor	MR = 0V, V <sub>CC</sub> = 5V	45	63	85	kΩ
<b>Watchdog Timer (NOT available on STM703/704/819)</b>							
	t <sub>WD</sub>	Watchdog Timeout Period	V <sub>RST</sub> (max) < V <sub>CC</sub> < 5.5V	1.12	1.60	2.24	s
		WDI Pulse Width	V <sub>RST</sub> (max) < V <sub>CC</sub> < 5.5V	50			ns
<b>Chip-Enable Gating (STM818 only)</b>							
E-to-E <sub>CON</sub> Resistance			V <sub>CC</sub> = V <sub>RST</sub> (max)		40	150	Ω
E-to-E <sub>CON</sub> Propagation Delay			4.5V < V <sub>CC</sub> < 5.5V		2	7	ns
Reset-to-E <sub>CON</sub> High Delay			(Power-down)		15		μs
E <sub>CON</sub> Short Circuit Current			V <sub>CC</sub> = 5V, Disable Mode, E = Logic high, E <sub>CON</sub> = 0V	0.1	0.75	2.0	mA

- Note: 1. Valid for Ambient Operating Temperature: T<sub>A</sub> = -40 to 85°C; V<sub>CC</sub> = 4.75V to 5.5V for "L" versions; V<sub>CC</sub> = 4.5V to 5.5V for "M" versions; and V<sub>BAT</sub> = 2.8V (except where noted).
2. V<sub>CC</sub> supply current, logic input leakage, Watchdog functionality, Push-button Reset functionality, PFI functionality, state of RST and RST tested at V<sub>BAT</sub> = 3.6V, and V<sub>CC</sub> = 5.5V. The state of RST or RST and PFO is tested at V<sub>CC</sub> = V<sub>CC</sub> (min). Either V<sub>CC</sub> or V<sub>BAT</sub> can go to 0V if the other is greater than 2.0V.
3. V<sub>CC</sub> (min) = 1.0V for T<sub>A</sub> = 0°C to +85°C.
4. Tested at V<sub>BAT</sub> = 3.6V, V<sub>CC</sub> = 3.5V and 0V.
5. Guaranteed by design.
6. 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 10μA and a maximum output capacitance of 200pF. The output device must also be able to source and sink at least 200μA when active.
7. When V<sub>BAT</sub> > V<sub>CC</sub> > V<sub>RST</sub>, V<sub>OUT</sub> remains connected to V<sub>CC</sub> until V<sub>CC</sub> drops below V<sub>RST</sub>.
8. When V<sub>RST</sub> > V<sub>CC</sub> > V<sub>BAT</sub>, V<sub>OUT</sub> remains connected to V<sub>CC</sub> until V<sub>CC</sub> drops below the battery voltage (V<sub>BAT</sub>) - 75mV.
9. For V<sub>CC</sub> falling.

PACKAGE MECHANICAL

Figure 44. SO8 – 8-lead Plastic Small Outline, 150 mils body width, Package Mech. Drawing



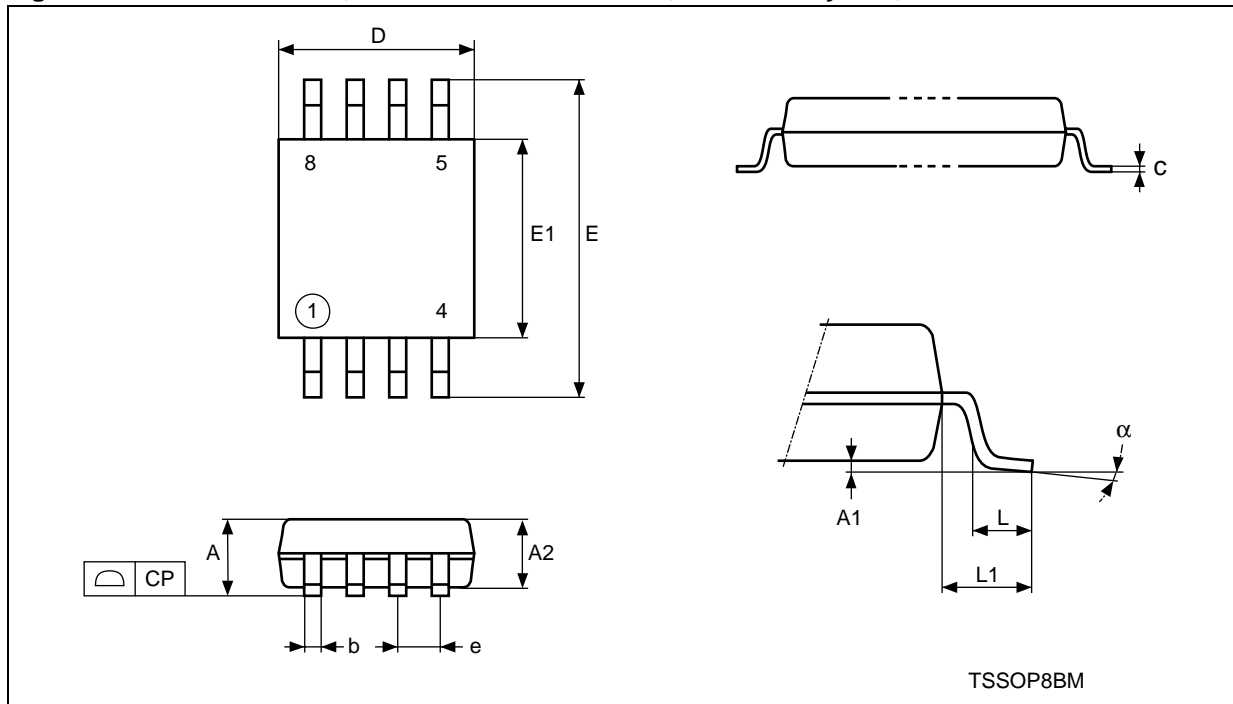
Note: Drawing is not to scale.

Table 8. SO8 – 8-lead Plastic Small Outline, 150 mils body width, Package Mechanical Data

Symb	mm			inches		
	Typ	Min	Max	Typ	Min	Max
A	–	1.35	1.75	–	0.053	0.069
A1	–	0.10	0.25	–	0.004	0.010
B	–	0.33	0.51	–	0.013	0.020
C	–	0.19	0.25	–	0.007	0.010
D	–	4.80	5.00	–	0.189	0.197
ddd	–	–	0.10	–	–	0.004
E	–	3.80	4.00	–	0.150	0.157
e	1.27	–	–	0.050	–	–
H	–	5.80	6.20	–	0.228	0.244
h	–	0.25	0.50	–	0.010	0.020
L	–	0.40	0.90	–	0.016	0.035
α	–	0°	8°	–	0°	8°
N	8			8		



Figure 45. TSSOP8 – 8-lead, Thin Shrink Small Outline, 3x3mm body size, Outline



Note: Drawing is not to scale.

Table 9. TSSOP8 – 8-lead, Thin Shrink Small Outline, 3x3mm body size, Mechanical Data

Symb	mm			inches		
	Typ	Min	Max	Typ	Min	Max
A	–	–	1.10	–	–	0.043
A1	–	0.05	0.15	–	0.002	0.006
A2	0.85	0.75	0.95	0.034	0.030	0.037
b	–	0.25	0.40	–	0.010	0.016
c	–	0.13	0.23	–	0.005	0.009
CP	–	–	0.10	–	–	0.004
D	3.00	2.90	3.10	0.118	0.114	0.122
e	0.65	–	–	0.026	–	–
E	4.90	4.65	5.15	0.193	0.183	0.203
E1	3.00	2.90	3.10	0.118	0.114	0.122
L	0.55	0.40	0.70	0.022	0.016	0.030
L1	0.95	–	–	0.037	–	–
α	–	0°	6°	–	0°	6°
N	8			8		

**PART NUMBERING**

**Table 10. Ordering Information Scheme**

Example:	STM690A	M	6	E
<b>Device Type</b>				
STM690A/692A/703/704/802/805/817/818/819				
<b>Reset Threshold Voltage</b>				
STM690A/703: blank = $V_{RST} = 4.50V$ to $4.75V$				
STM8xxL: L = $V_{RST} = 4.50V$ to $4.75V$				
STM692A/704: blank = $V_{RST} = 4.25V$ to $4.50V$				
STM8xxM: M = $V_{RST} = 4.25V$ to $4.50V$				
<b>Package</b>				
M = SO8				
DS <sup>(1)</sup> = TSSOP8				
<b>Temperature Range</b>				
6 = $-40$ to $85^{\circ}C$				
<b>Shipping Method</b>				
E = Tubes				
F = Tape & Reel				

Note: 1. Contact local ST sales office for availability.

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

**Table 11. Marking Description**

Part Number	Reset Threshold	Package	Topside Marking
STM690A	4.65V	SO8	690A
STM692A	4.65V	SO8	692A
STM703	4.65V	SO8	703
STM704	4.40V	SO8	704
STM802L	4.65V	SO8	802L
STM802M	4.40V	SO8	802M
STM805L	4.65V	SO8	805L
STM817L	4.65V	SO8	817L
		TSSOP8	
STM817M	4.40V	SO8	817M
		TSSOP8	
STM818L	4.65V	SO8	818L
		TSSOP8	
STM818M	4.40V	SO8	818M
		TSSOP8	
STM819L	4.65V	SO8	819L
		TSSOP8	
STM819M	4.40V	SO8	819M
		TSSOP8	

## REVISION HISTORY

**Table 12. Document Revision History**

Date	Version	Revision Details
October 2003	1.0	First Issue
31-Oct-03	1.1	Update DC Characteristics (Table 7)
22-Dec-03	2.0	Reformatted; updated characteristics (Figure 1, 3, 4, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17; Table 3, 4, 7, 9, 11)
16-Jan-04	2.1	Add Typical Characteristics (Figure 19, 20, 22, 23, 25, 26, 27, 28, 29, 32, 33, 34, 35, 36, 37, 38, 39)
08-Apr-04	2.2	Update characteristics (Figure 13, 23, 29, 33, 34, 35, 38; Table 1,7)
25-May-04	3.0	Remove references to 'Open Drain' (Figure 2, 5, 8; Table 2); update characteristics (Table 3, 7)
05-Jul-04	4.0	Update package availability, pin description; promote document (Figure 1, 14, 15; Table 3, 7, 10)
29-Sep-04	5.0	Clarify root part numbers, pin descriptions (Figure 11, 13, 40; Table 7, 10)
01-Mar-05	6.0	Update characteristics (Figure 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39)

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