



Is Now Part of



**ON Semiconductor®**

To learn more about ON Semiconductor, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

# AN-9716

## Reset Timers

### Applications

As smart phones continually add functionality, it increases the likelihood of device lock up. This condition has been called the “White Screen of Death” which is a new take on the popular phrase used to describe Windows PCs after a system fault. Before the advent of standalone reset timers, users were required to remove the phone battery to force a device restart. As more device suppliers remove access to the device battery, it has become necessary to provide a more convenient way of forcing a device reset.

Reset timers create a failsafe mechanism for users to reset the phone using a single- or multiple-button long key press. Reset timers have an advantage over software solutions in that the independent, hardware-based solution is not susceptible to software crashes. The need for hardware-based reset timers is the result of an increased likelihood that device operating systems can be derailed by the growing applications and features they must support.



Figure 1. “White Screen of Death” Example

## Considerations in Choosing a Reset Timer

### Configurable Reset Time

Is it unclear what the final reset time should be? Are you concerned that the preset reset time is too close to a critical system timing parameter? Fairchild reset timers feature selectable reset times (*see Table 1*). When choosing a reset timer, select a delay sufficient to prevent unintended resets caused by accidental key presses. For this reason, the shortest reset configuration offered by Fairchild reset timers is three seconds.

### Reset Timer Output Type

Fairchild offers open-drain and push-pull outputs that vary in the output pulse duration. In reset timers where the last digit in the product name is 0, i.e. FT8010, the reset output signal remains LOW or HIGH for the entire time the SRx inputs are held LOW (as long as the initial reset time requirement was met). In this case, as soon as either SRx input is released, the reset outputs return to their default states. Reset timers where the last digit is 1, i.e. FT7521, feature a fixed-output pulse width of 400ms, regardless of the time when the SRx pins are released. Figure 2 illustrates the relationship between SRx and the output signal generated by the reset timer.

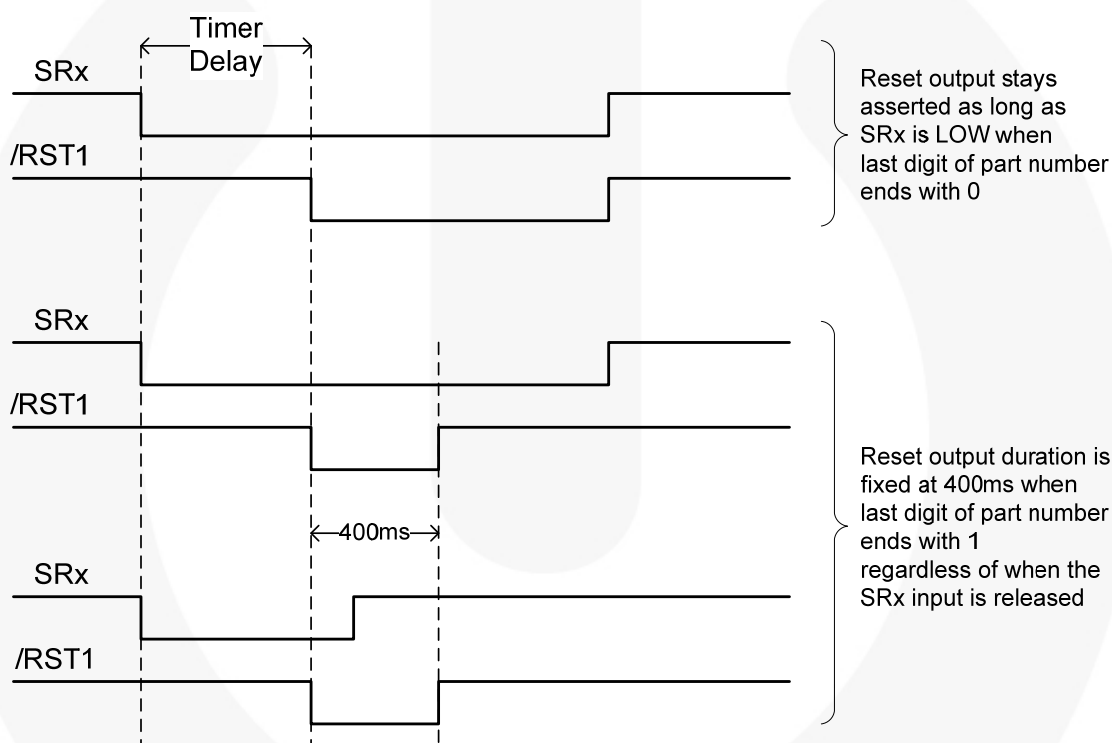


Figure 2. Reset Time Output Pulse Type

## Application Examples

### Example 1:

The reset timer output is connected to the gate control of a power PFET in series with the battery supply. By using the push-pull output, the reset timer immediately shuts the power FET off when the reset timer output is driven HIGH. The duration of the output pulse is not important because shutting off the PFET starves the remaining circuitry of

power and forces a system reboot when the reset timer output returns to default state. Note that, as soon as the reset timer output goes HIGH, the device screen goes black, indicating that the reset function has been enabled and it is OK to release the reset button(s). In this case, the desired reset time and availability of a push-pull output option are important in the selection of a reset timer.

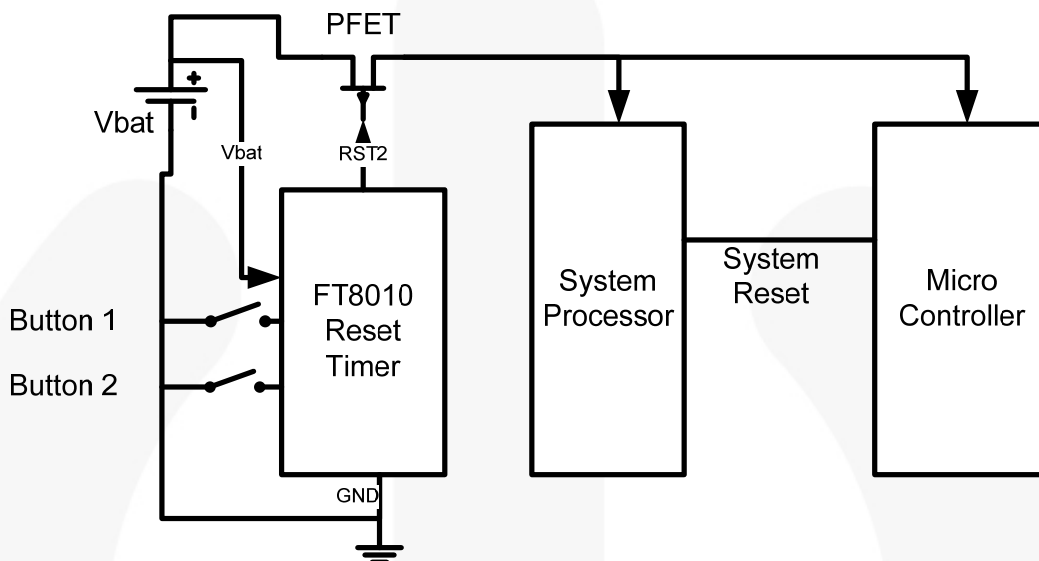


Figure 3. Application Example Scenario 1, Timer Output as Power FET Gate Control

### Example 2:

As shown in Figure 4, the reset timer output is connected to the power management IC (PMIC), which then controls the system processor. For this application, the reset timer output signals the PMIC to reset by asserting a reset pin on the PMIC. The PMIC immediately resets and sends a fixed-pulse to the central processor, which signals it to also reset.

Similar to the first example, the output pulse duration is not critical in this application because the phone reset sequence begins as soon as the reset timer output is asserted. The desired reset time and availability of the correct output type are critical in selecting a reset timer for this application.

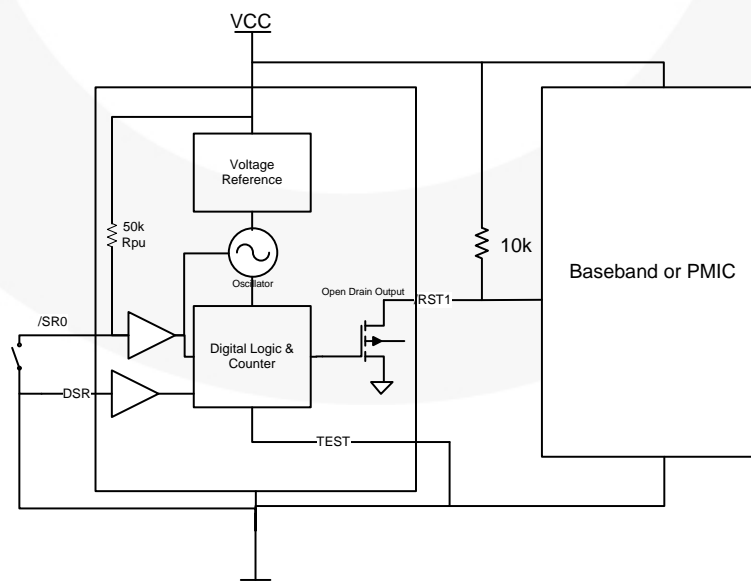


Figure 4. Application Example Scenario 2, Timer Output into PMIC using the FT7521

**Example 3:**

In this final example, the reset time output feeds directly into both the PMIC and central processor. In the previous examples, the user has visual cues that the system had been reset before the reset chip output signal has returned to its default state.

In this last application, the central processor may require a pulse in the reset pin to begin the reset process; the user can

hold the reset buttons, waiting for an indication of reset, if a reset timer without the fixed output pulse is chosen.

Selecting a reset timer with a fixed output pulse<sup>(1)</sup>, allows the system to begin the reset process before the user releases the buttons to provide a better user experience.

**Note:**

1. This feature is offered by Fairchild's FTXXX1 series.

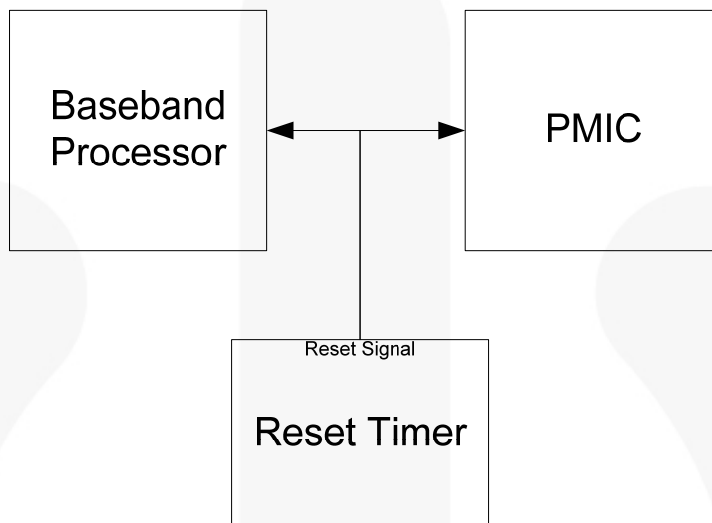


Figure 5. Application Example Scenario 3, Timer Output into PMIC and Baseband

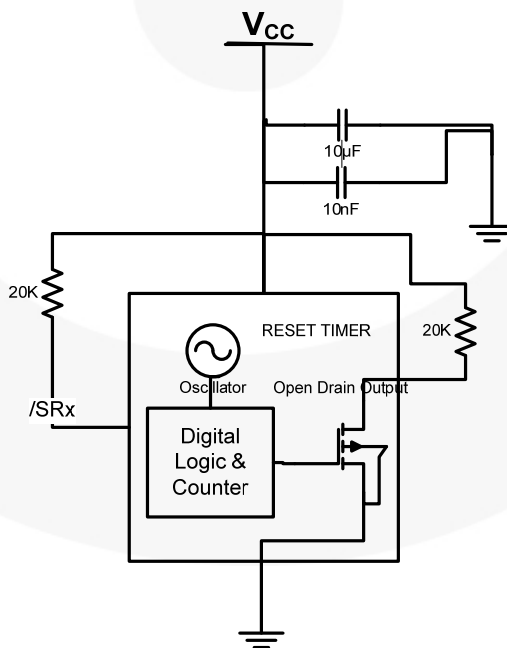
**Reference Schematic for FT-Series Devices**

Figure 6. Reset Timer Decoupling and Pull-Up Resistor Reference Schematic (FT8010<sup>(2)</sup> Shown)

## Decoupling Capacitor Value and Placement

Decoupling capacitors should be placed as close to the  $V_{CC}$  supply pin of the reset timer as possible. Decoupling values shown here are typical values, where the larger 10 $\mu$ F capacitor is used to stabilize the reset timer supply voltage in the event of significant loading on the power supply that could lead to supply droop. Depending on the stability of the system supply, this value could be reduced. Fairchild recommends that the final value be between 1 $\mu$ F and 10 $\mu$ F.

The second, smaller capacitor is included to filter high-frequency power supply noise and provide a return path for fast edge rate transient voltages. This value can also be adjusted to suit the specific needs of the application. Fairchild recommends it be in the range of 10nF to 100nF.

There is flexibility in the selection of pull-up resistor values on the SRx inputs and open-drain output. The reference schematic in Figure 6 provides a conservative estimate for

the pull-up resistor values with the intent to limit system power consumption while the SRx inputs and open-drain output are held LOW. Fairchild reset timer outputs are designed to sink, at most, 500 $\mu$ A. Based on this and the assumption of a worst-case  $V_{CC}$  supply referenced pull-up voltage of 5V, the minimum pull-up resistor value should be 10k $\Omega$ . Larger pull-up values result in less current consumption when in LOW state.

When choosing a pull-up resistor, the designer must also consider the desired edge of the output/input transition. Larger values, while saving power, result in slower output/input transitions as a function of the pull-up resistance and line capacitance. In most reset time applications, output/input transition times are not critical and the designer opts for lower power consumption by choosing a larger pull-up resistor.

**Table 1. Reset Timer Selection Table**

Reset Timer	Fixed-Output Pulse	Open-Drain Output	0-Second Test Mode	Integrated Pull-Up	Time Duration	Static Current	Number of Reset Inputs
FT8010	No	Yes	No	No	7.5, 11.25 Seconds	20 $\mu$ A	2
FT7521	Yes	Yes	Yes	Yes	7.5 Seconds	1 $\mu$ A	1
FT3001	Yes	Yes	No	No	3, 3.75, 4.5, 6 Seconds	1 $\mu$ A	2
FT10001	Yes	Yes	Yes	Yes	10 Seconds	1 $\mu$ A	1

**Note:**

2. FT7521 and FT10001 have a built-in pull-up resistor on the reset timer input /SR0; therefore, external pull-up resistors are not required.

## Application Guidelines

Table 2 should help the designers properly configure the reset timer.

Following these suggestions avoids errors, increasing the probability first pass design success.

**Table 2. Use Guidelines**

Do	Don't
Tie TRIG to GND for Normal Operating	Tie the TRIG to $V_{CC}$
Tie DSR to Valid $V_{CC}$ or GND Before Power-up	Leave DSR Floating
Leave the DSR Pin Unchanged During Normal Operation	Change the DSR Pin During Normal Operation
Pull-Up Resistor Connected for Output /RST1	No Pull-Up Resistor Connected for Output /RST1

## Summary

Reset timers provide a solution to the “White Screen of Death” crash and subsequent need to reboot in portable devices. Selection of the best timer in the application occurs after considering the system requirements, where the reset

timer delay and output pulse types are generally the deciding factors. Depending on the application, there is a solution available with devices that offer both push-pull and open-drain outputs.

## Related Datasheets

[\*FT8010 — Reset Timer with Configurable Delay Time\*](#)

[\*FT7521 — Reset Timer with Fixed Delay and Reset Pulse\*](#)

[\*FT3001 — Reset Timer with Configurable Delay Time\*](#)

[\*FT10001 — Reset Timer with Fixed Delay and Reset Pulse\*](#)

### DISCLAIMER


FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

### LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada

**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910

**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)

**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local  
Sales Representative