APPLICATION NOTE 1186

Ultra Low Power Reset Generator

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Abstract: This application note describes an ultra-low power microprocessor reset generator that is capable of operating for decades from a single AA Lithium cell. Where continuous intermittent reset is desired, this relaxation-oscillator circuit can provide adjustable pulse width and reset period. Typical operation producing 100µs pulses each second requires only 1µA current from a 1.8-5.5V supply. Formulas are provided for calculation of component values for a wide range of pulse width and period.

When a processor-controlled device must be guaranteed to operate, designers often choose to reset the processor periodically rather than rely on a watchdog circuit. In low-power systems the periodic reset generator can consume a large part of the system current budget or may not be guaranteed to operate at low voltages.

This application note describes a low-power reset generator that generates a low going reset pulse of 100µS duration once per second, consumes less than 1µA and will operate from 1.8V to 5V with only slight variation of the output period.

![Circuit Diagram]

Figure 1. This reset circuit consumes less than 1µA and delivers a 100-µsec-wide reset pulse every 1.3 sec.

The circuit is an adaptation of a normal relaxation oscillator with a differentiator and diode clamp on the output to generate the 100µS low going pulse. The pulse width can be adjusted by varying \( C_p \) or \( R_p \) and...
the polarity changed by repositioning D₁. The period can be adjusted by varying R₁ or C₁.

The 350nA supply current, 1.8V-5.5V supply voltage range and SOT23 package make the MAX919 ideal for this application. Measurements for the complete circuit give operating currents of less than 1µA at 25°C, which would allow the circuit to operate from a single AA lithium cell for 250 years!

With careful component choice this circuit is able to generate periods from mS to minutes. To ensure good temperature stability R₁ and Rp should be metal film and C₁ and Cp should be NP0 type capacitors. Assuming a CMOS type input, high impedance and with a logic threshold of 30% of the supply rail, then the following formulas can be used to adjust the output pulse width and period:

Pulse width \( \approx 0.36 \frac{R_p C_p}{R_1} \)
Period \( \approx 1.4 \frac{R_1 C_1}{R_p} \)

Measured pulse width:

1.308 seconds @ 4.5V
1.306 seconds @ 1.8V

![Figure 2. Comparator output; horizontal scale = 200mS/div, vertical scale = 1V/div, supply voltage = 4.5V, amplitude = 4.48Vp-p, period = 1.310 seconds.](image-url)
Figure 3. Comparator output; horizontal scale = 200mS/div, vertical scale = 500mV/div, supply voltage = 1.7V, amplitude = 1.7Vp-p, period = 1.308 seconds.

Figure 4. Pulse output; horizontal scale = 100µS/div, vertical scale = 1V/div, supply voltage = 4.5V, pulse width (30%) = 100µS.
Figure 5. Clamp over shoot (at pulse output); horizontal scale = 50µS/div, vertical scale = 50mV/div, supply voltage = 4.5V, clamp over shoot = 162mV.

A similar version of this article appeared in the June 27, 2002 issue of EDN magazine.

Related Parts

| MAX919   | SOT23, 1.8V, Nanopower, Beyond-the-Rails Comparators With/Without Reference | Free Samples |

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