

## Low-Voltage Supervisory Circuit with Watchdog and Manual Reset

### Features

- Precision Low Voltage Monitoring
- 200-ms (typical) Reset Timeout
- Watchdog Timer with 1.6-sec Timeout
- Manual Reset Input
- Reset Output Stage
- Push-Pull Active-Low
- Low-Power Consumption: 2.2  $\mu\text{A}$
- Guaranteed Reset Output valid to  $V_{\text{CC}} = 1\text{ V}$
- Power Supply Glitch Immunity
- Specified from  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$
- SOT23-5 Package

### Applications

- Microprocessor Systems
- Computers
- Controllers
- Intelligent Instruments
- Portable Equipment

### Description

The TPV6823 is a supervisory circuit that monitors power supply voltage levels and provides a power-on reset signal.

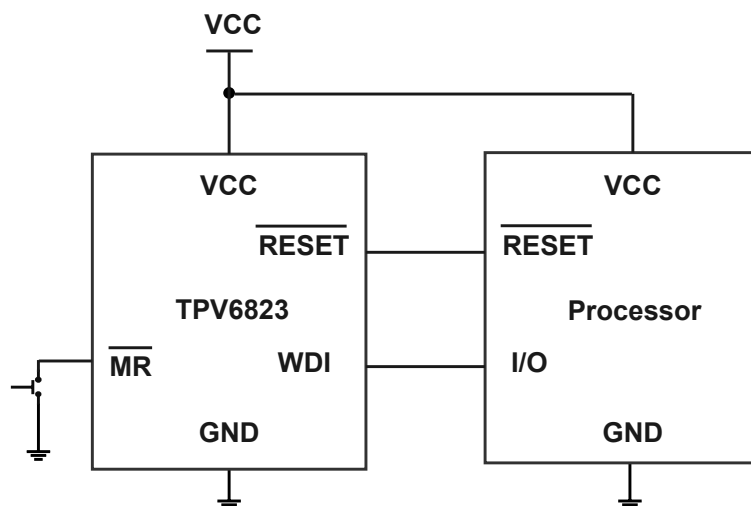
It also has an on-chip watchdog timer, which can give out a reset signal if the microprocessor fails to strobe the watchdog timer within a preset timeout period.

A reset signal can also be asserted by an external manual reset input.

The reset and watchdog timeout periods are fixed at 200 ms (typical) and 1.6 sec (typical) respectively.

The TPV6823 is available in a SOT23-5 package and typically consumes only 2.2  $\mu\text{A}$ , suitable for use in low-power and portable applications.

### Typical Application Circuit



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## Product Family Table

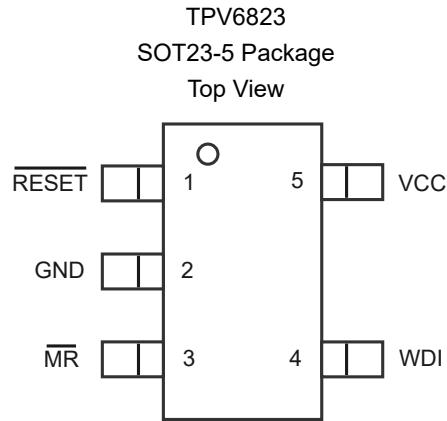
| Order Number               | Threshold Voltage (V) | Marking Information | Package |
|----------------------------|-----------------------|---------------------|---------|
| TPV6823V-TR                | 1.58                  | V1V                 | SOT23-5 |
| TPV6823W-TR <sup>(1)</sup> | 1.67                  | V1W                 | SOT23-5 |
| TPV6823Y-TR                | 2.19                  | V1Y                 | SOT23-5 |
| TPV6823Z-TR <sup>(1)</sup> | 2.32                  | V1Z                 | SOT23-5 |
| TPV6823R-TR                | 2.63                  | V1R                 | SOT23-5 |
| TPV6823S-TR                | 2.93                  | V1S                 | SOT23-5 |
| TPV6823T-TR <sup>(1)</sup> | 3.08                  | V1T                 | SOT23-5 |
| TPV6823M-TR <sup>(1)</sup> | 4.38                  | V1M                 | SOT23-5 |
| TPV6823L-TR <sup>(1)</sup> | 4.63                  | V1L                 | SOT23-5 |

(1) For future products, contact the 3PEAK factory for more information and samples.

## Revision History

| Date       | Revision | Notes                                                                                                                                                                                                                                                                                                                                                 |
|------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2018-12-10 | Rev.A.0  | First release version.                                                                                                                                                                                                                                                                                                                                |
| 2019-04-15 | Rev.A.1  | Updated package POD information.                                                                                                                                                                                                                                                                                                                      |
| 2019-05-28 | Rev.A.2  | Added WDI pulse interval spec.                                                                                                                                                                                                                                                                                                                        |
| 2021-08-26 | Rev.A.3  | Updated Format and added Application Note.                                                                                                                                                                                                                                                                                                            |
| 2021-11-22 | Rev.A.4  | Corrected POD.                                                                                                                                                                                                                                                                                                                                        |
| 2023-10-09 | Rev.A.5  | <ul style="list-style-type: none"> <li>Updated datasheet format.</li> <li>Added note in Product family table.</li> <li>Corrected <math>I_{CC\ max}(@V_{CC}=5\ V)</math> to 25 <math>\mu A</math>, <math>V_{TH\ max}</math> value of TPV6823Y to 2.28 V.</li> <li>Updated reset timing diagram.</li> <li>Removed power up/down restriction.</li> </ul> |

## Pin Configuration and Functions



**Table 1. Pin Functions: TPV6823**

| Pin |                           | I/O | Description                                                                                                                                                                                                                            |
|-----|---------------------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NO. | Name                      |     |                                                                                                                                                                                                                                        |
| 1   | $\overline{\text{RESET}}$ | O   | Active-Low Reset Push-Pull Output Stage. Asserted whenever $V_{CC}$ is below the reset threshold, $V_{TH}$ .                                                                                                                           |
| 2   | GND                       | -   | Ground.                                                                                                                                                                                                                                |
| 3   | $\overline{\text{MR}}$    | I   | Manual Reset Input. This is an active-low input, which, when forced low for at least 1 $\mu\text{s}$ , generates a reset. It features a 50-k $\Omega$ internal pull-up.                                                                |
| 4   | WDI                       | I   | Watchdog Input. The watchdog input generates a reset if the voltage on the pin remains low or high for the duration of the watchdog timeout. The timer is cleared if a logic transition occurs on this pin or if a reset is generated. |
| 5   | VCC                       | -   | Power Supply Voltage Monitored.                                                                                                                                                                                                        |

## Low-Voltage Supervisory Circuit with Watchdog and Manual Reset

### Specifications

#### Absolute Maximum Ratings

| Parameter        |                                     | Min  | Max | Unit |
|------------------|-------------------------------------|------|-----|------|
| Input Voltage    | VCC                                 | -0.3 | 6   | V    |
| Output Current   | $\overline{\text{RESET}}$           |      | 20  | mA   |
| T <sub>J</sub>   | Maximum Junction Temperature        | -40  | 125 | °C   |
| T <sub>STG</sub> | Storage Temperature Range           | -65  | 150 | °C   |
| T <sub>L</sub>   | Lead Temperature (Soldering 10 sec) |      | 260 | °C   |

- (1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.
- (2) This data was taken with the JEDEC low effective thermal conductivity test board.
- (3) This data was taken with the JEDEC standard multilayer test boards.

#### ESD, Electrostatic Discharge Protection

| Parameter |                          | Condition                             | Minimum Level | Unit |
|-----------|--------------------------|---------------------------------------|---------------|------|
| HBM       | Human Body Model ESD     | ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup> | 4             | kV   |
| CDM       | Charged Device Model ESD | ANSI/ESDA/JEDEC JS-002 <sup>(2)</sup> | 2             | kV   |

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

#### Thermal Information

| Package Type | $\theta_{JA}$ | $\theta_{JC}$ | Unit |
|--------------|---------------|---------------|------|
| SOT23-5      | 128           | 67            | °C/W |

**Low-Voltage Supervisory Circuit with Watchdog and Manual Reset**
**Electrical Characteristics**

 All test conditions:  $V_{CC} = 1.53\text{ V to }5.5\text{ V}$ ,  $T_A = -40^\circ\text{C to }+125^\circ\text{C}$ , unless otherwise noted.

| Parameter                                    |                                                         | Conditions                                                   | Min                 | Typ                            | Max                 | Unit                  |
|----------------------------------------------|---------------------------------------------------------|--------------------------------------------------------------|---------------------|--------------------------------|---------------------|-----------------------|
| <b>Supply Voltage and Current</b>            |                                                         |                                                              |                     |                                |                     |                       |
| $V_{CC}$                                     | VCC Operating Voltage Range                             |                                                              | 1                   |                                | 5.5                 | V                     |
| $I_{CC}$                                     | Supply Current                                          | WDI and MR unconnected<br>( $V_{CC} = 1.8\text{ V}$ )        |                     | 2.2                            | 10                  | $\mu\text{A}$         |
|                                              |                                                         | WDI and MR unconnected<br>( $V_{CC} = 5\text{ V}$ )          |                     | 6                              | 25                  | $\mu\text{A}$         |
| $V_{TH}$                                     | Reset Threshold Voltage                                 | TPV6823V                                                     | 1.51                | 1.58                           | 1.63                | V                     |
|                                              |                                                         | TPV6823W                                                     | 1.62                | 1.67                           | 1.71                | V                     |
|                                              |                                                         | TPV6823Y                                                     | 2.12                | 2.19                           | 2.28                | V                     |
|                                              |                                                         | TPV6823Z                                                     | 2.25                | 2.32                           | 2.38                | V                     |
|                                              |                                                         | TPV6823R                                                     | 2.55                | 2.63                           | 2.70                | V                     |
|                                              |                                                         | TPV6823S                                                     | 2.85                | 2.93                           | 3.00                | V                     |
|                                              |                                                         | TPV6823T                                                     | 3.00                | 3.08                           | 3.15                | V                     |
|                                              |                                                         | TPV6823M                                                     | 4.25                | 4.38                           | 4.5                 | V                     |
|                                              |                                                         | TPV6823L                                                     | 4.5                 | 4.63                           | 4.75                | V                     |
|                                              | Reset Threshold Temperature Coefficient                 |                                                              |                     | 60                             |                     | ppm/ $^\circ\text{C}$ |
| $V_{HYS}$                                    | Reset Threshold Hysteresis                              |                                                              |                     | $2 \times \frac{V_{TH}}{1000}$ |                     | mV                    |
| $t_{RD}$                                     | VCC To Reset Delay                                      | $V_{TH} - V_{CC} = 100\text{ mV}$                            |                     | 20                             |                     | $\mu\text{s}$         |
| $t_{RP}$                                     | Reset Timeout Period                                    |                                                              | 140                 | 200                            | 280                 | ms                    |
| $V_{OL}$                                     | Reset Output Voltage Low (Push-Pull)                    | $V_{CC} \geq 1\text{ V}$ , $I_{SINK} = 50\ \mu\text{A}$      |                     |                                | 0.3                 | V                     |
| $V_{OH}$                                     | Reset Output Voltage High (Push-Pull Only)              | $V_{CC} \geq 1.8\text{ V}$ , $I_{SOURCE} = 200\ \mu\text{A}$ | $0.8 \times V_{CC}$ |                                |                     | V                     |
| <b><math>\overline{\text{MR}}</math> Pin</b> |                                                         |                                                              |                     |                                |                     |                       |
| $V_{IL\_MR}$                                 | Input Threshold Voltage Low for $\overline{\text{MR}}$  |                                                              |                     |                                | $0.3 \times V_{CC}$ | V                     |
| $V_{IH\_MR}$                                 | Input Threshold Voltage High for $\overline{\text{MR}}$ |                                                              | $0.7 \times V_{CC}$ |                                |                     | V                     |
| $t_{PW\_MR}$                                 | $\overline{\text{MR}}$ Input Pulse Width                |                                                              | 1                   |                                |                     | $\mu\text{s}$         |
| $t_{GR\_MR}$                                 | $\overline{\text{MR}}$ Glitch Rejection                 |                                                              |                     | 100                            |                     | ns                    |
| $t_{d\_MR}$                                  | $\overline{\text{MR}}$ to Reset Delay                   |                                                              |                     | 200                            |                     | ns                    |
| $R_{PU\_MR}$                                 | $\overline{\text{MR}}$ Pull-Up Resistance               |                                                              |                     | 50                             |                     | k $\Omega$            |
| <b>WDI Pin</b>                               |                                                         |                                                              |                     |                                |                     |                       |
| $t_{WD}$                                     | Watchdog Timeout Period                                 |                                                              | 1.12                | 1.6                            | 2.4                 | s                     |

**Low-Voltage Supervisory Circuit with Watchdog and Manual Reset**

| Parameter    |                         | Conditions         | Min                 | Typ | Max                 | Unit    |
|--------------|-------------------------|--------------------|---------------------|-----|---------------------|---------|
| $t_{PW\_WD}$ | WDI Pulse Width 50 ns   |                    | 50                  |     |                     | ns      |
| $V_{IL\_WD}$ | WDI Input Threshold VIL |                    |                     |     | $0.3 \times V_{CC}$ | V       |
| $V_{IH\_WD}$ | WDI Input Threshold VIH |                    | $0.7 \times V_{CC}$ |     |                     | V       |
| $I_{WDI}$    | WDI Input Current       | $V_{WDI} = V_{CC}$ |                     | 20  |                     | $\mu A$ |
|              |                         | $V_{WDI} = 0$      |                     | -15 |                     | $\mu A$ |

Typical Performance Characteristics

All test conditions:  $V_{CC} = 3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$ , unless otherwise noted.

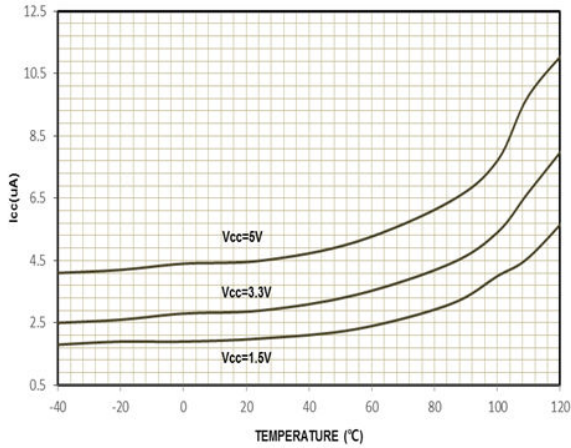


Figure 1. Supply Current vs. Temperature

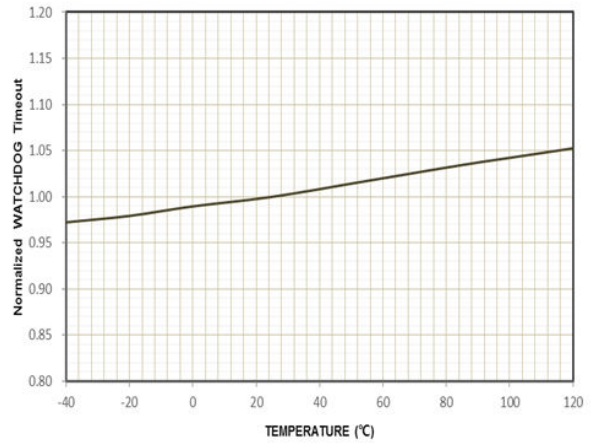


Figure 2. Normalized Watchdog Timeout Period vs. Temperature

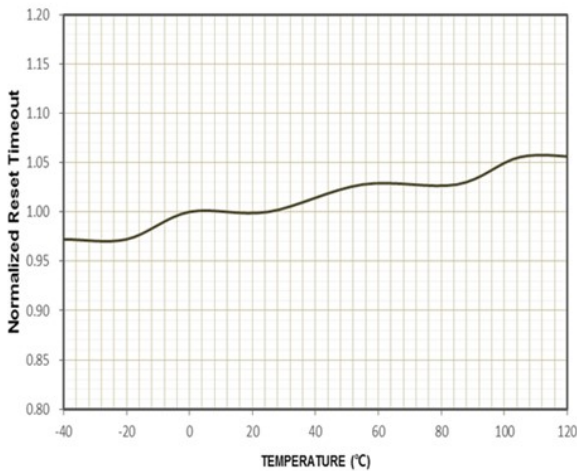


Figure 3. Normalized Reset Timeout Period vs. Temperature

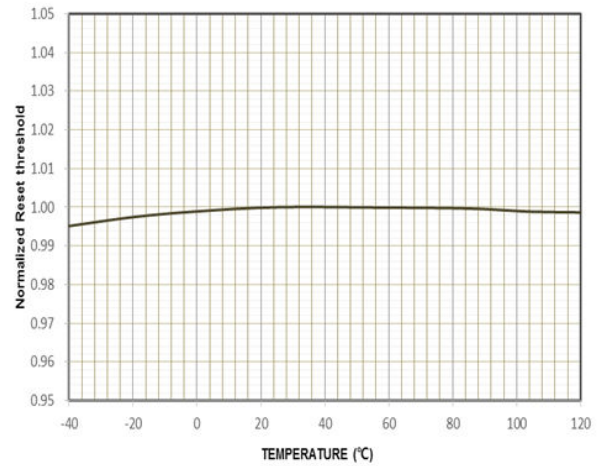


Figure 4. Normalized Reset Threshold vs. Temperature



Low-Voltage Supervisory Circuit with Watchdog and Manual Reset

Typical Performance Characteristics (continued)

All test conditions:  $V_{CC} = 3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$ , unless otherwise noted.

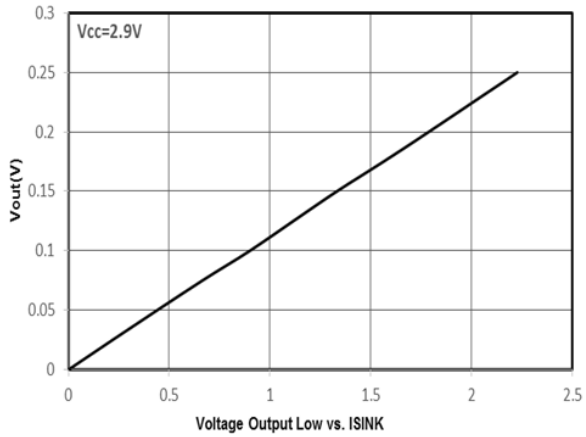


Figure 5. Voltage Output Low vs.  $I_{SINK}$

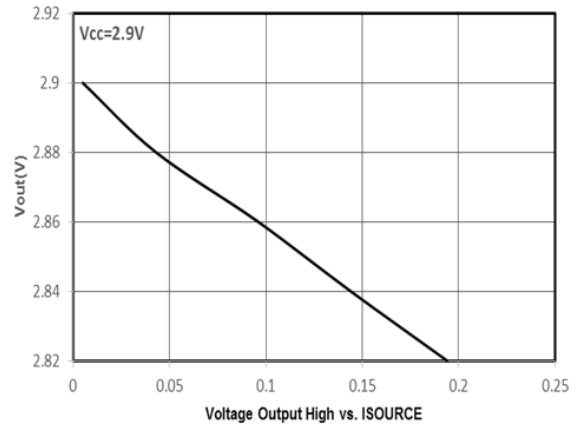


Figure 6. Voltage Output High vs.  $I_{SOURCE}$

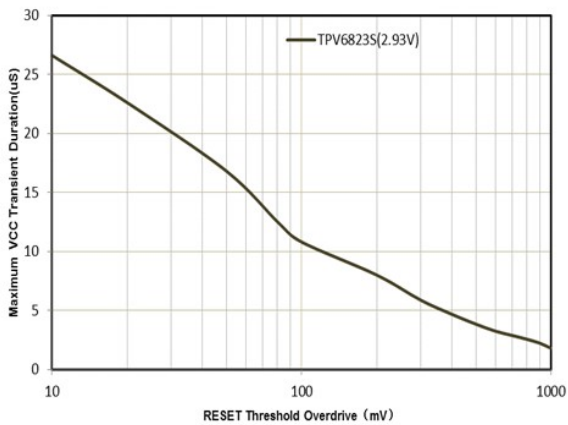


Figure 7. Maximum VCC Transient Duration vs. Reset Threshold Overdrive

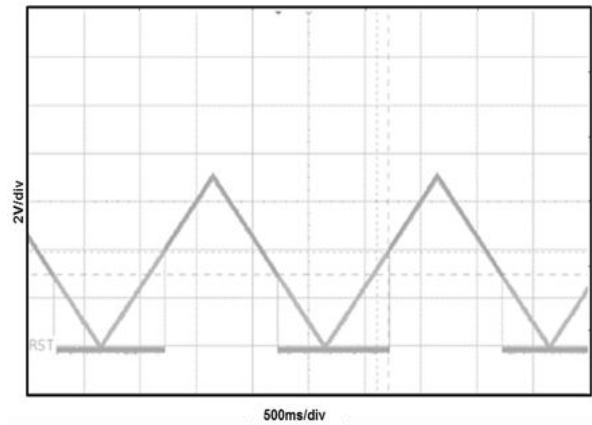


Figure 8. Reset Output Voltage vs Supply Voltage

## Detailed Description

### Overview

The TPV6823 provides supply voltage supervision as well as manual reset and watchdog functions.

A reset signal is asserted when the supply voltage is below a preset threshold. In addition, the TPV6823 allows supply voltage stabilization with a fixed timeout before the reset de-asserts after the supply voltage rises above the threshold.

A watchdog timer detects if the microprocessor code breaks down or becomes stuck in an infinite loop. If this happens, the watchdog timer asserts a reset pulse, which restarts the microprocessor in a known state.

A manual reset input is available to reset the microprocessor, for example, by using an external push-button.

### Functional Block Diagram

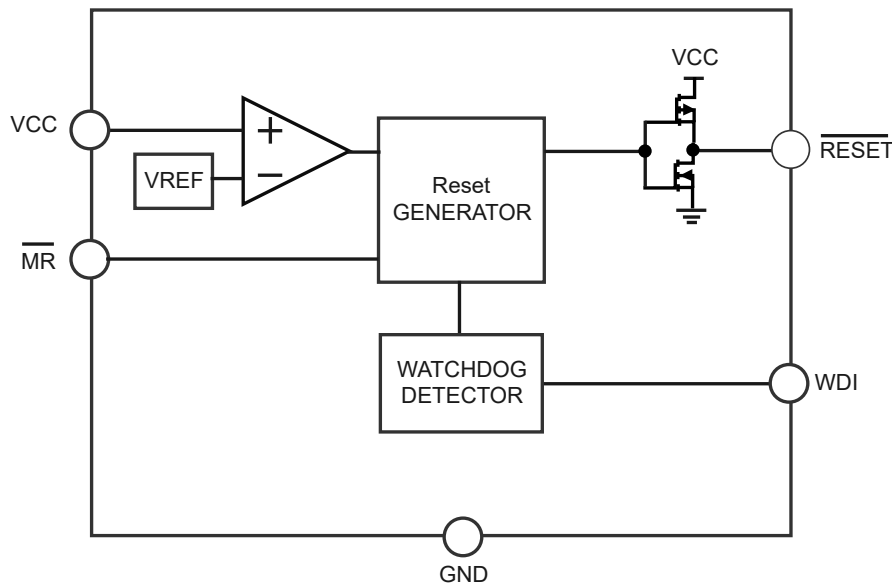


Figure 9. Functional Block Diagram

## Feature Description

### Reset Output

The TPV6823 features an active-low push-pull output. For active-low output, the reset signal is guaranteed to be logic low for  $V_{CC}$  down to 1 V. The reset output is asserted when  $V_{CC}$  is below the reset threshold ( $V_{TH}$ ), when  $\overline{MR}$  is driven low, or when WDI is not serviced within the watchdog timeout period ( $t_{WD}$ ). Reset remains asserted for the duration of the reset active timeout period ( $t_{RP}$ ) after  $V_{CC}$  rises above the reset threshold, after  $\overline{MR}$  transitions from low to high, or after the watchdog timer times out. Figure 10 shows the reset outputs.

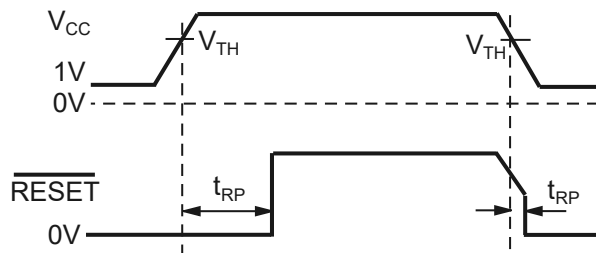


Figure 10. Reset Timing Diagram

### Manual Reset Input

The TPV6823 features a manual reset input ( $\overline{MR}$ ), which, when driven low, asserts the reset output. When  $\overline{MR}$  transitions from low to high, reset remains asserted for the duration of the reset active timeout period before de-asserting.

The  $\overline{MR}$  input has an internal pull-up resistor so that the input is always high when unconnected. Noise immunity is provided on the  $\overline{MR}$  input, and fast, negative-going transients are ignored. A 0.1- $\mu$ F capacitor between  $\overline{MR}$  and ground provides additional noise immunity.

### Watchdog Input

The TPV6823 features a watchdog timer, which monitors microprocessor activity. A timer circuit is cleared with every low-to-high or high-to-low logic transition on the watchdog input pin (WDI). If the timer counts through the preset watchdog timeout period ( $t_{WD}$ ), reset is asserted. The microprocessor is required to toggle the WDI pin to avoid being reset.

In addition to logic transitions on WDI, the watchdog timer is also cleared by a reset assertion due to an under-voltage condition on  $V_{CC}$  or  $\overline{MR}$  being pulled low. When reset is asserted, the watchdog timer is cleared and does not begin counting again until reset de-asserts. The watchdog timer can be disabled by leaving WDI floating or by three-stating the WDI driver.

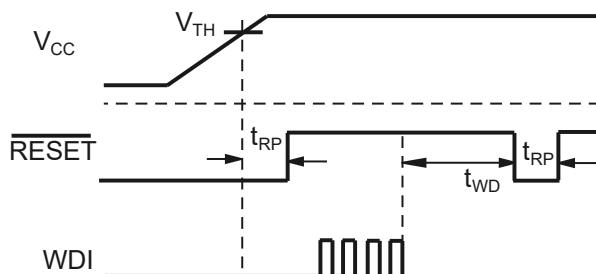


Figure 11. Watchdog Timing Diagram

## Application and Implementation

### Note

Information in the following application sections is not part of the 3PEAK's component specification and 3PEAK does not warrant its accuracy or completeness. 3PEAK's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

## Application Information

The TPV6823 is a supervisory circuit that monitors power supply voltage levels and provides a power-on reset signal.

It also has a on-chip watchdog timer, which can output a reset signal if the microprocessor fails to strobe the watchdog timer within a preset timeout period.

## Typical Application

The following figure shows the typical application schematic.

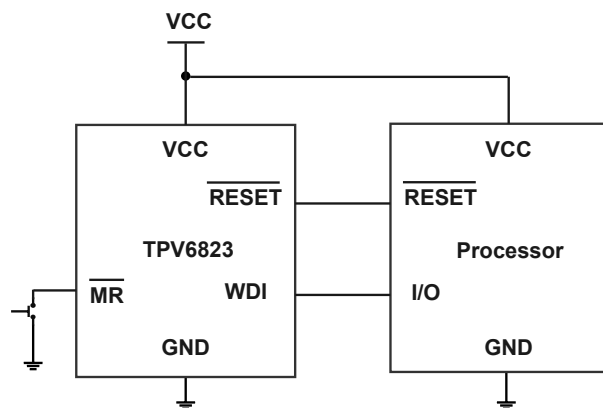
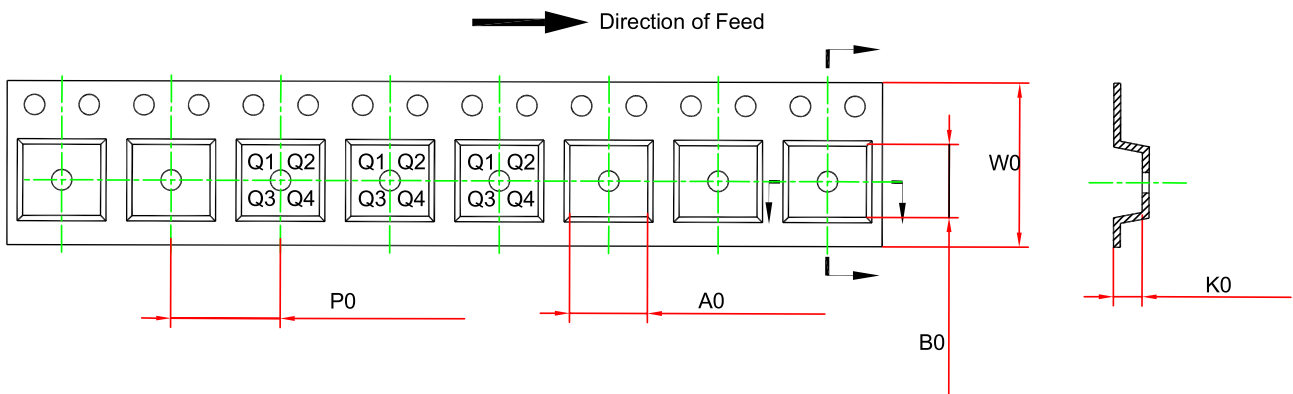
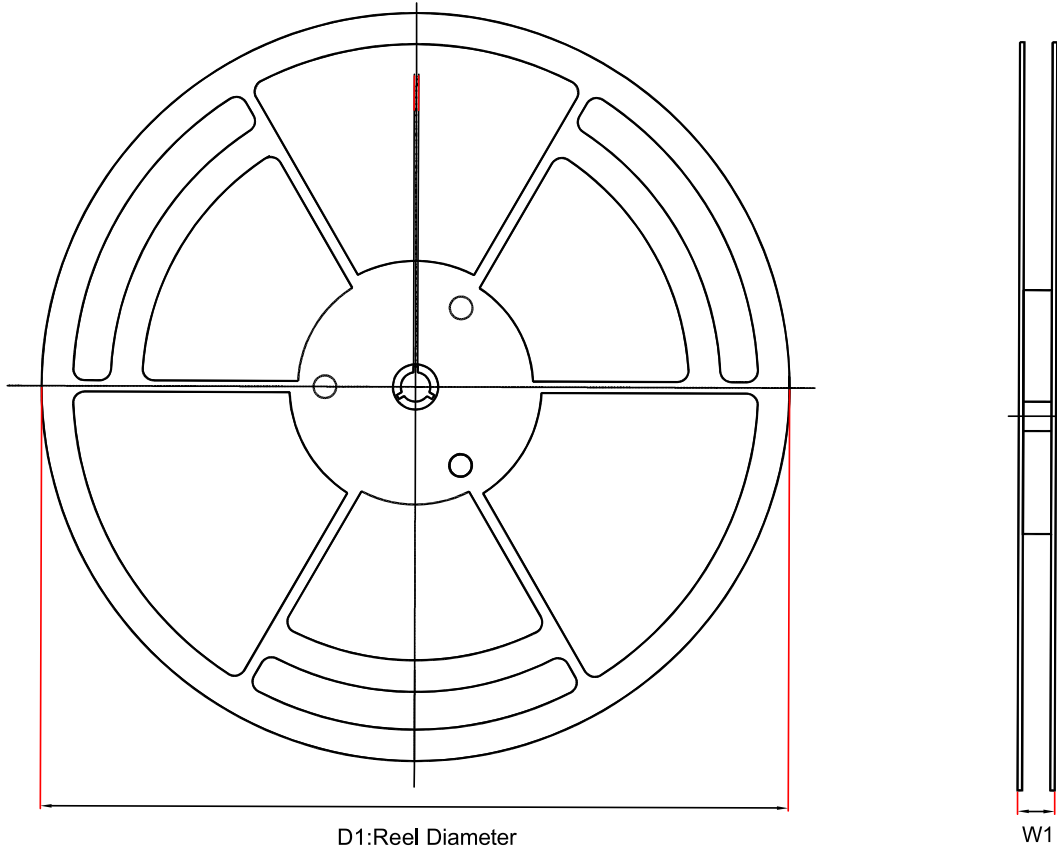


Figure 12. Typical Application Circuit

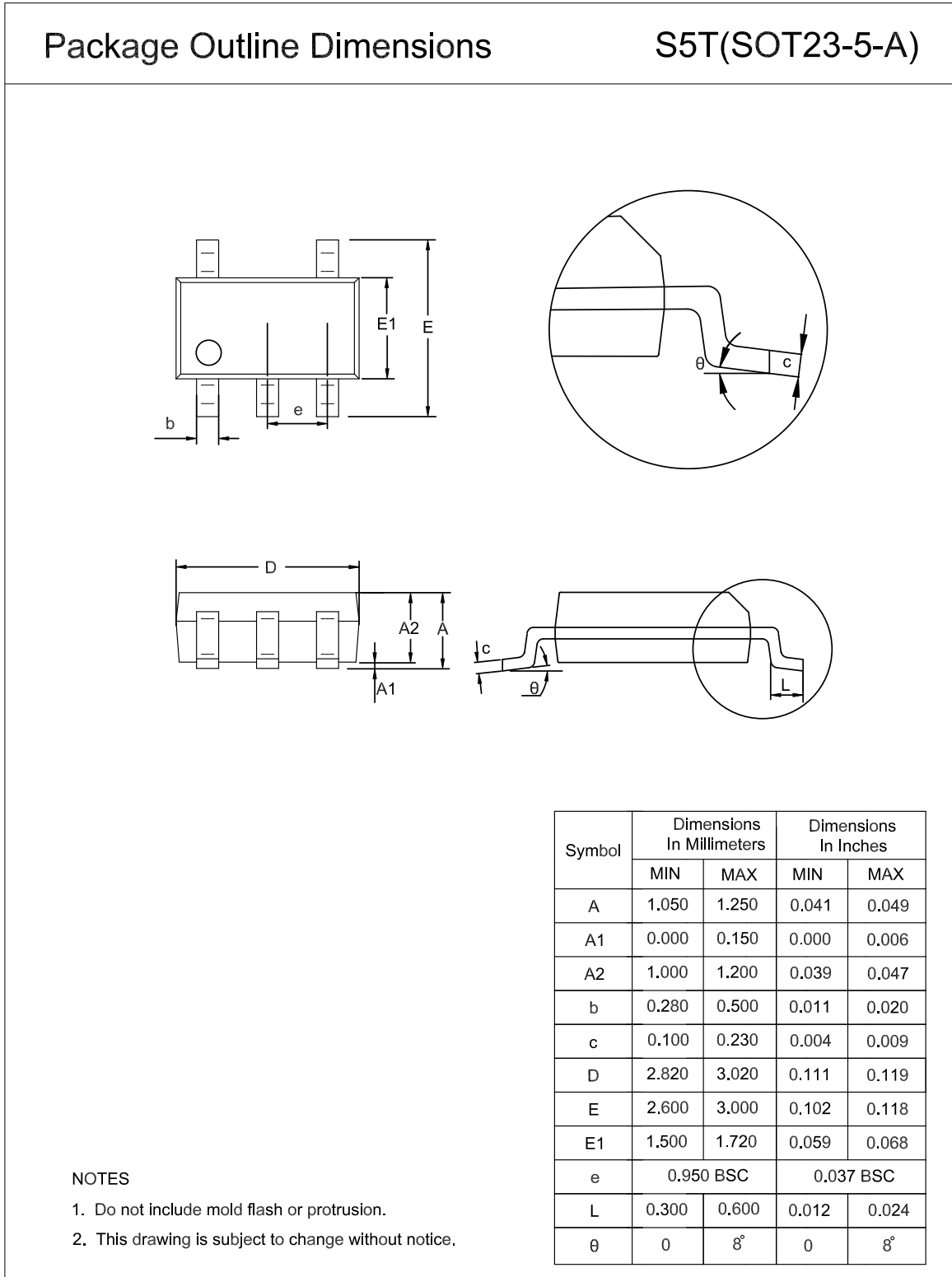
Tape and Reel Information



| Order Number | Package | D1 (mm) | W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | W0 (mm) | Pin1 Quadrant |
|--------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|
| TPV6823x-TR  | SOT23-5 | 180     | 13.1    | 3.2     | 3.2     | 1.4     | 4       | 8       | Q3            |

Package Outline Dimensions

SOT23-5



**Low-Voltage Supervisory Circuit with Watchdog and Manual Reset**
**Order Information**

| Order Number | Operating Temperature Range | Package | Marking Information | MSL | Transport Media, Quantity | Eco Plan |
|--------------|-----------------------------|---------|---------------------|-----|---------------------------|----------|
| TPV6823V-TR  | -40°C to 125°C              | SOT23-5 | V1V                 | 1   | Tape and Reel, 3,000      | Green    |
| TPV6823W-TR  | -40°C to 125°C              | SOT23-5 | V1W                 | 1   | Tape and Reel, 3,000      | Green    |
| TPV6823Y-TR  | -40°C to 125°C              | SOT23-5 | V1Y                 | 1   | Tape and Reel, 3,000      | Green    |
| TPV6823Z-TR  | -40°C to 125°C              | SOT23-5 | V1Z                 | 1   | Tape and Reel, 3,000      | Green    |
| TPV6823R-TR  | -40°C to 125°C              | SOT23-5 | V1R                 | 1   | Tape and Reel, 3,000      | Green    |
| TPV6823S-TR  | -40°C to 125°C              | SOT23-5 | V1S                 | 1   | Tape and Reel, 3,000      | Green    |
| TPV6823T-TR  | -40°C to 125°C              | SOT23-5 | V1T                 | 1   | Tape and Reel, 3,000      | Green    |
| TPV6823M-TR  | -40°C to 125°C              | SOT23-5 | V1M                 | 1   | Tape and Reel, 3,000      | Green    |
| TPV6823L-TR  | -40°C to 125°C              | SOT23-5 | V1L                 | 1   | Tape and Reel, 3,000      | Green    |

**Green:** 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.

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