

Low-Voltage Supervisory Circuits with Power-Fail Detector

Features

- Precision Low-Voltage Monitoring and Power-Fail Detector
- 200-ms (typical) Reset Timeout
- Manual Reset Input
- Independent Watchdog Timer
- Reset Output Stage
- Push-pull Active-low Output
- Low Power Consumption: 4- μ A
- Guaranteed Reset Output Valid to $V_{CC} = 1$ V
- Power Supply Glitch Immunity
- Temperature Range: -40°C to 125°C
- SOP8 Package

Applications

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

Description

The TPV706C is a supervisory circuit to monitor power supply voltage levels and provides a power-on reset signal.

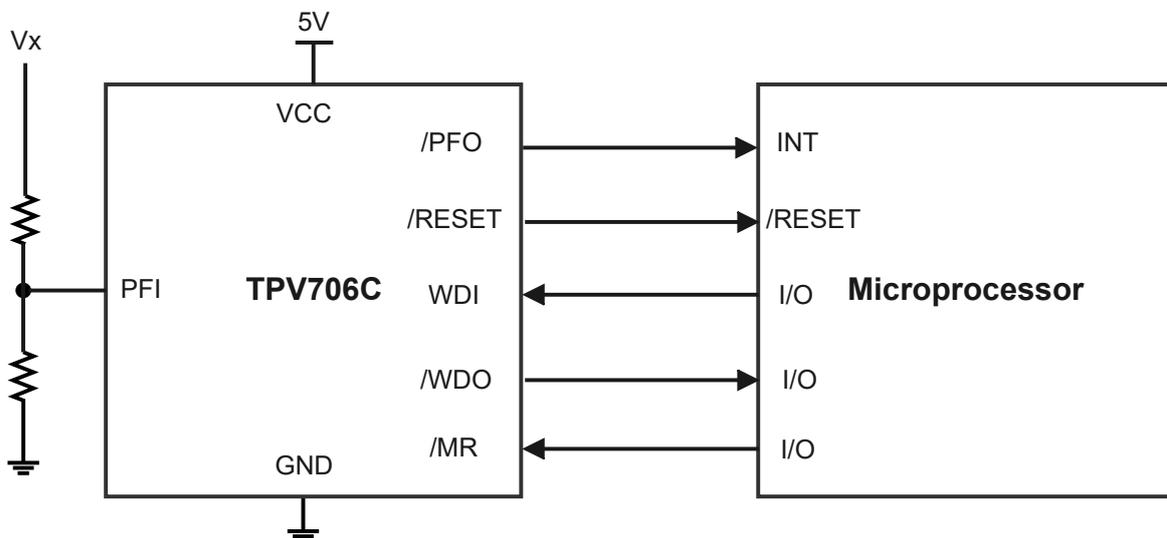
A watchdog monitor is provided, which is activated if the watchdog input doesn't toggle within 1.6 sec.

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

In addition, there is a power-fail detector with a 1.25-V threshold, which can be used to monitor an additional power supply.

The reset periods are fixed at 200-ms (typical). The TPV706C is available in an 8-pin SOP package and typically consumes only 4- μ A, which is suitable for low-power and portable applications.

Typical Application Circuit



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Product Family Table

Order Number	Threshold Voltage (V_{TH})	Package Marking	Package
TPV706CVL1-SR ⁽¹⁾	1.58	C6V	SOP8
TPV706CWL1-SR ⁽¹⁾	1.67	C6W	SOP8
TPV706CYL1-SR ⁽¹⁾	2.19	C6Y	SOP8
TPV706CZL1-SR ⁽¹⁾	2.32	C6Z	SOP8
TPV706CRL1-SR	2.63	C6R	SOP8
TPV706CSL1-SR	2.93	C6S	SOP8
TPV706CTL1-SR	3.08	C6T	SOP8
TPV706CML1-SR ⁽¹⁾	4.38	C6M	SOP8
TPV706CLL1-SR ⁽¹⁾	4.63	C6L	SOP8

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

Revision History

Date	Revision	Notes
2025-06-09	Rev.A.0	Initial version.

Pin Configuration and Functions

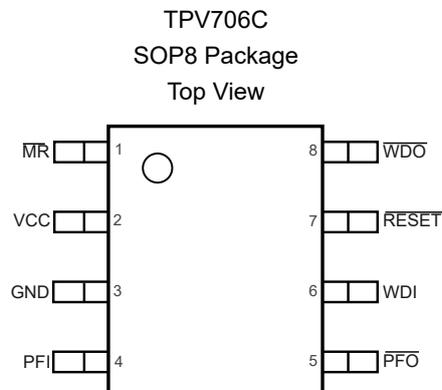


Table 1. Pin Functions: TPV706C

Pin		I/O	Description
No.	Name		
1	$\overline{\text{MR}}$	I	Manual Reset Input. $\overline{\text{MR}}$ low asserts $\overline{\text{RESET}}$ pin. It features an internal pull-up current.
2	VCC	P	Power supply voltage being monitored.
3	GND	G	Ground. This pin should be connected to ground reference.
4	PFI	I	Power fail input. When PFI is less than 1.25-V, $\overline{\text{PFO}}$ goes low. If unused, connect PFI to GND.
5	$\overline{\text{PFO}}$	O	Power fail output. It goes low when PFI is less than 1.25-V, otherwise stays high.
6	WDI	I	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. Floating WDI disables the watchdog function.
7	$\overline{\text{RESET}}$	O	Active-Low Reset Push-Pull Output Stage. Asserted whenever VCC is below the reset threshold or by a low signal on the $\overline{\text{MR}}$ input. It remains low for 200-ms after VCC goes above the reset threshold or $\overline{\text{MR}}$ goes from low to high. A watchdog timeout does not trigger $\overline{\text{RESET}}$.
8	$\overline{\text{WDO}}$	O	Watchdog Output. Pulls low if WDI remains low or high for the duration of the watchdog timeout, and does not go high again until the watchdog is cleared. Whenever VCC is below the reset threshold, $\overline{\text{WDO}}$ stays low. As soon as VCC rises above the reset threshold, $\overline{\text{WDO}}$ goes high with no delay.

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Specifications

Absolute Maximum Ratings

Parameter		Min	Max	Unit
V _{CC}	Power Supply	-0.3	6	V
	Output Current		20	mA
T _J	Maximum Junction Temperature		150	°C
T _A	Operating Temperature Range	-40	125	°C
T _{STG}	Storage Temperature Range	-65	150	°C
T _L	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 ⁽¹⁾	4	kV
CDM	Charged Device Model ESD	ANSI/ESDA/JEDEC JS-002 ⁽²⁾	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	θ_{JA}	θ_{JC}	Unit
SOP8	143	60	°C/W

Low-Voltage Supervisory Circuits with Power-Fail Detector
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	
Supply Voltage and Current						
V_{CC}	Operating Supply Voltage	1		5.5	V	
I_{CC}	Supply Current	WDI and MR unconnected ($V_{CC} = 1.8\text{ V}$)		4	15	μA
		WDI and MR unconnected ($V_{CC} = 5\text{ V}$)		6	20	μA
V_{TH}	Reset Threshold Voltage	TPV706CV	1.51	1.58	1.63	V
		TPV706CW	1.62	1.67	1.71	V
		TPV706CY	2.12	2.19	2.25	V
		TPV706CZ	2.25	2.32	2.38	V
		TPV706CR	2.55	2.63	2.70	V
		TPV706CS	2.82	2.93	3.00	V
		TPV706CT	3.00	3.08	3.15	V
		TPV706CM	4.25	4.38	4.5	V
		TPV706CL	4.5	4.63	4.75	V
	Reset Threshold Temperature Coefficient		80		ppm/ $^\circ\text{C}$	
V_{HYS}	Reset Threshold Hysteresis		$2 \times V_{TH}$		mV	
t_{RD}	V_{CC} to Reset Delay		20		μs	
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
		$I_{SINK} = 1.2\text{ mA}$ @ $V_{CC} \geq 2\text{ V}$			0.4	V
V_{OH}	Reset Output Voltage High (Push-Pull)	$I_{SOURCE} = 800\ \mu\text{A}$, @ $V_{CC} \geq 5\text{ V}$	$0.7 \times V_{CC}$			V
$\overline{\text{MR}}$ Pin						
V_{IL_MR}	$\overline{\text{MR}}$ Input Threshold V_{IL}			$0.3 \times V_{CC}$	V	
V_{IH_MR}	$\overline{\text{MR}}$ Input Threshold V_{IH}		$0.7 \times V_{CC}$		V	
t_{PW_MR}	$\overline{\text{MR}}$ Input Pulse Width ⁽¹⁾		6		μs	
t_{GR_MR}	$\overline{\text{MR}}$ Glitch Rejection		100		ns	
t_{d_MR}	$\overline{\text{MR}}$ to Reset Delay		1	6	μs	
I_{MR_V0}	$\overline{\text{MR}}$ Pull-up Current	$V_{CC} = 3\text{ V}$		80	μA	
t_{WD}	Watchdog Timeout Period		1	1.6	2.4	sec
t_{PW_WD}	WDI Pulse Width 50 ns		50			ns

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Parameter		Conditions	Min	Typ	Max	Unit
V _{IL_WDI}	WDI input threshold V _{IL}				0.3 × V _{CC}	V
V _{IH_WDI}	WDI input threshold V _{IH}		0.7 × V _{CC}			V
I _{WDI}	WDI input current	V _{WDI} = V _{CC}		20		μA
		V _{WDI} = 0		-15		μA
V _{OL_WDO}	$\overline{\text{WDO}}$ V _{OL}	I _{SINK} = 1.2 mA @ V _{CC} ≥ 5 V			0.4	V
V _{OH_WDO}	$\overline{\text{WDO}}$ V _{OH}	I _{SOURCE} = 800 μA @ V _{CC} ≥ 5 V	0.7 × V _{CC}			V
PFI and $\overline{\text{PFO}}$						
V _{TH_PFI}	Power fail input threshold	PFI falling	1.18	1.25	1.32	V
V _{OL_PFO}	$\overline{\text{PFO}}$ V _{OL}	I _{SINK} = 1.6 mA @ V _{CC} ≥ 5 V			0.4	V
V _{OH_PFO}	$\overline{\text{PFO}}$ V _{OH}	I _{SOURCE} = 800 μA @ V _{CC} ≥ 5 V	0.7 × V _{CC}			V

(1) MR pulse width given by the customer in the application should be longer than the minimum value of the MR input pulse width requirement.

Typical Performance Characteristics

All test conditions: $V_{CC} = 5\text{ V}$, $T_A = +25^\circ\text{C}$, unless otherwise noted.

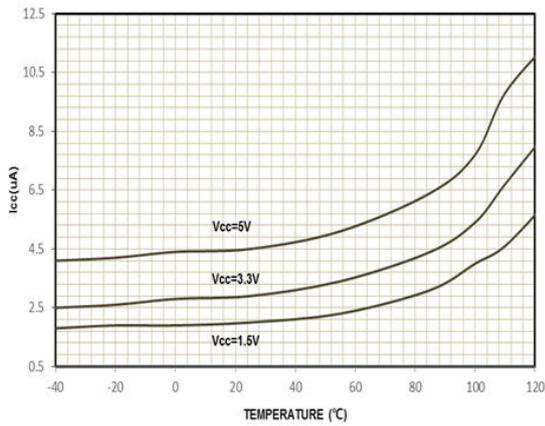


Figure 1. Supply Current vs. Temperature

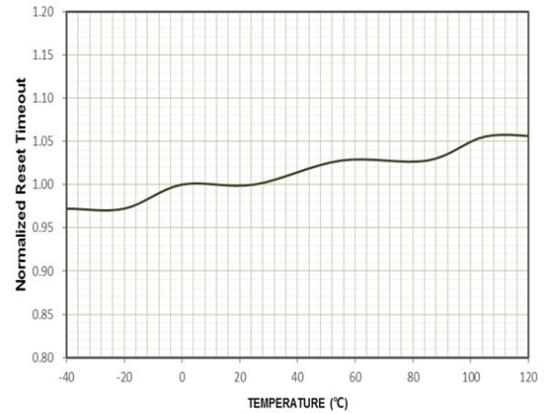


Figure 2. Normalized RESET Timeout Period vs. Temperature

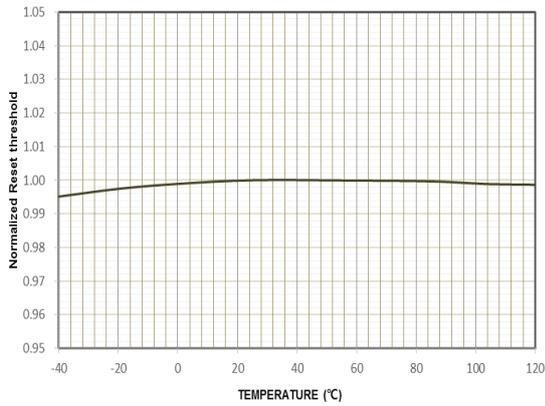


Figure 3. Normalized RESET Threshold vs. Temperature

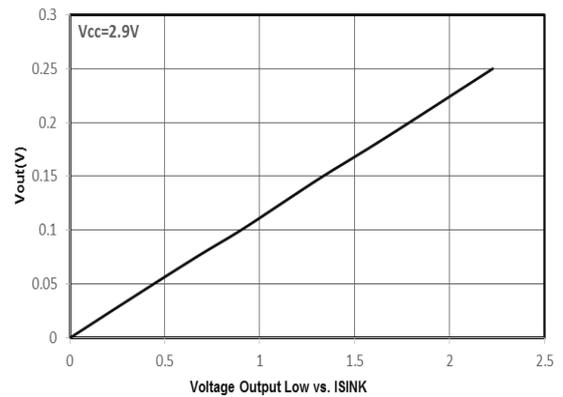


Figure 4. Voltage Output Low vs. ISINK

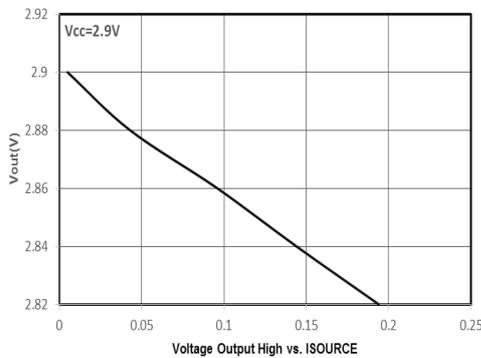


Figure 5. Voltage Output High vs. ISOURCE

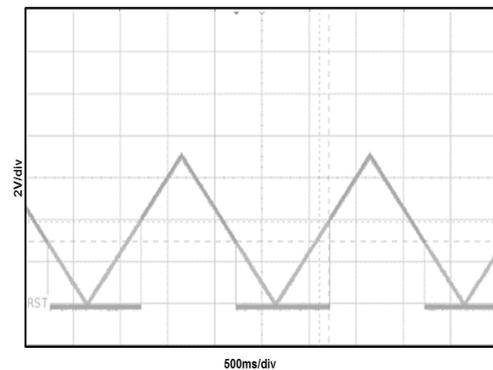


Figure 6. Reset Output Voltage vs. Supply Voltage

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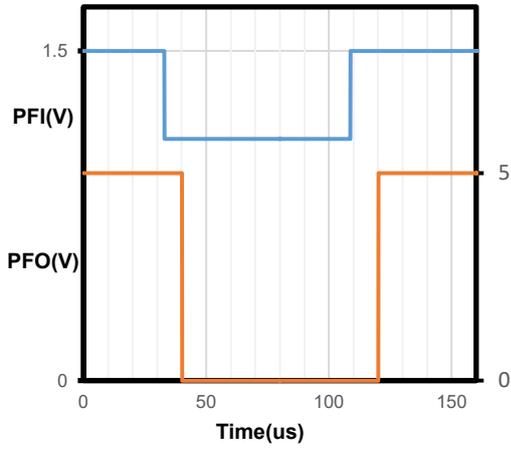


Figure 7. PFI vs. PFO

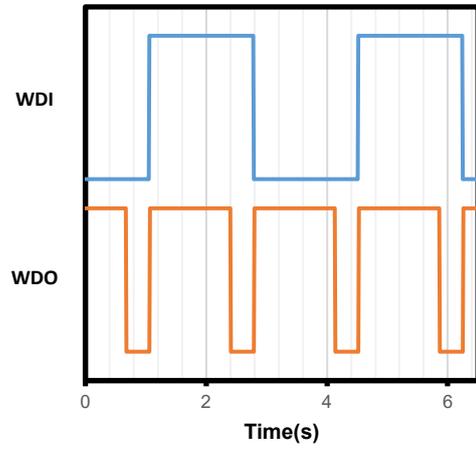


Figure 8. WDI vs. WDO

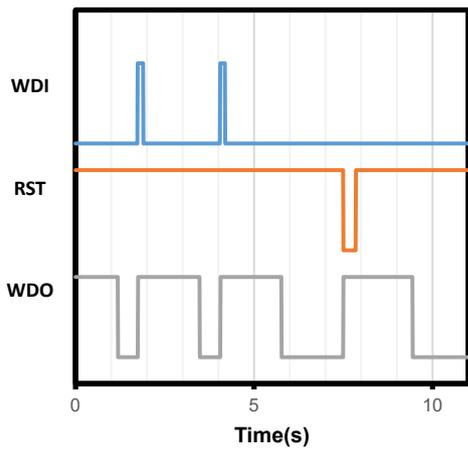


Figure 9. WDI vs. RST and WDO

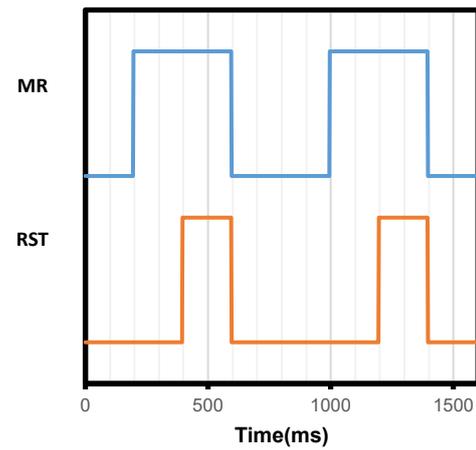


Figure 10. MR vs. RST

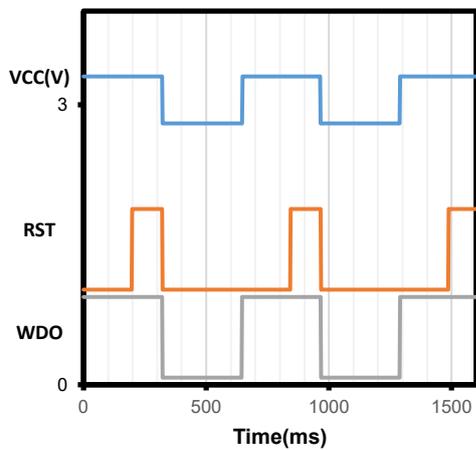


Figure 11. Vcc vs. RST and WDO

Detailed Description

Overview

The TPV706C provides supply voltage supervision, watchdog function, manual reset function, as well as a 1.25-V power-fail comparator.

Functional Block Diagram

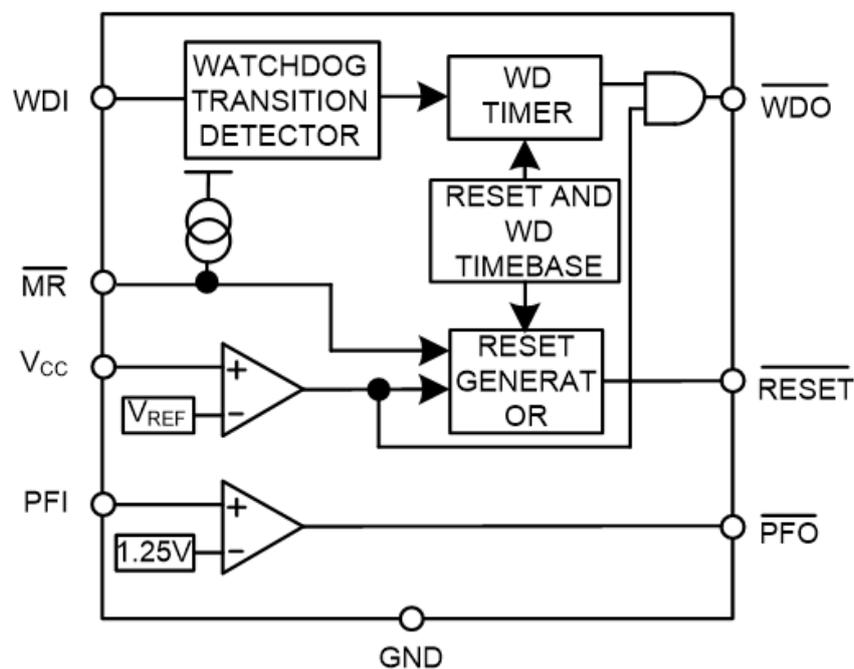


Figure 12. Functional Block Diagram

Feature Description

RESET Output

The TPV706C features an active-low push-pull 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}), or when MR is driven low. Reset remains asserted for the duration of the reset active timeout period (t_{RP}) after V_{CC} rises above the reset threshold, or after MR transitions from low to high. [Figure 13](#) shows the reset (active low) outputs.

Low-Voltage Supervisory Circuits with Power-Fail Detector

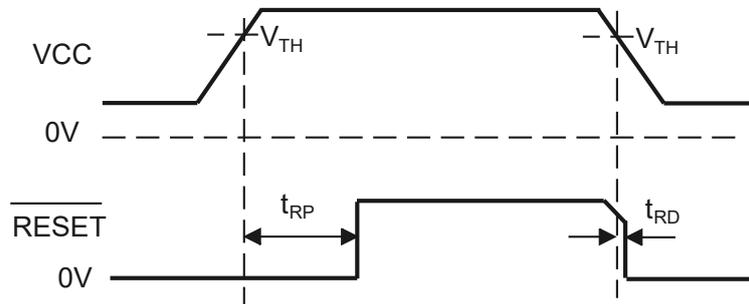


Figure 13. Reset Timing Diagram

Manual RESET Input

The TPV706C features a manual reset input ($\overline{\text{MR}}$), which, when driven low, asserts the reset output. When $\overline{\text{MR}}$ transitions from low to high, reset remains asserted for the duration of the reset active timeout period before de-asserting.

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

Watchdog Input

The TPV706C 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 ($\overline{\text{WDI}}$). If the timer counts through the preset watchdog timeout period (t_{WD}), the watchdog output ($\overline{\text{WDO}}$) goes low, a low-to-high or high-to-low transition on the $\overline{\text{WDI}}$ pin clears the watchdog timer. The delay time from $\overline{\text{WDI}}$ toggling to $\overline{\text{WDO}}$ going high is within 35-ms. The microprocessor is required to toggle the $\overline{\text{WDI}}$ pin to avoid being reset. Whenever VCC is below the reset threshold, $\overline{\text{WDO}}$ stays low. As soon as VCC rises above the reset threshold, $\overline{\text{WDO}}$ goes high with no delay. Figure 14 shows the watchdog timing.

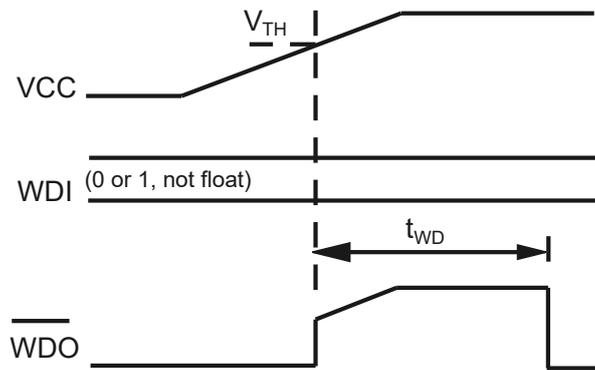


Figure 14. Watchdog Timing

Power-Fail Detector

The power-fail detector is a 1.25-V comparator, which can monitor an external power supply through a resistive divider. When the voltage on the PFI is lower than 1.25-V, the comparator output goes low, indicating a power fail, which can be used as an early warning of the power fail.

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

Figure 15 shows the typical application circuit of TPV706C. Microprocessor activity is monitored using WDI. When the WDI remains low or high for the duration of the watchdog timeout, the WDO will trigger a manual reset to the MCU. The MCU can drive the \overline{MR} from high to low and trigger the \overline{RESET} .

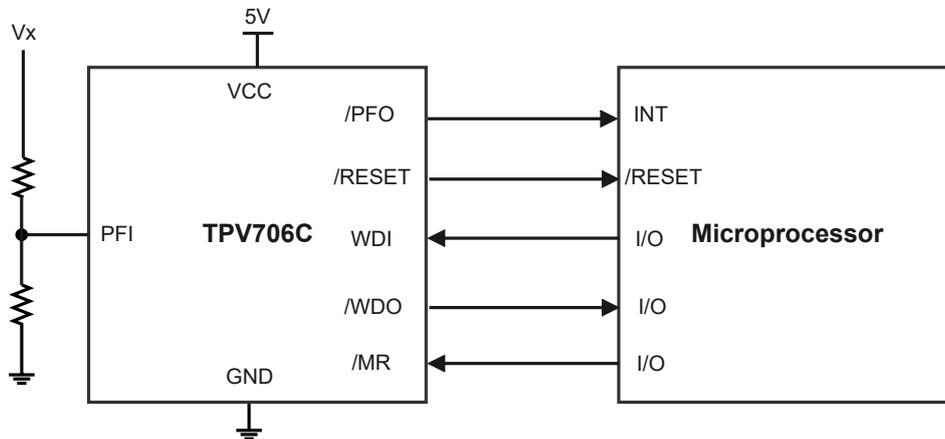
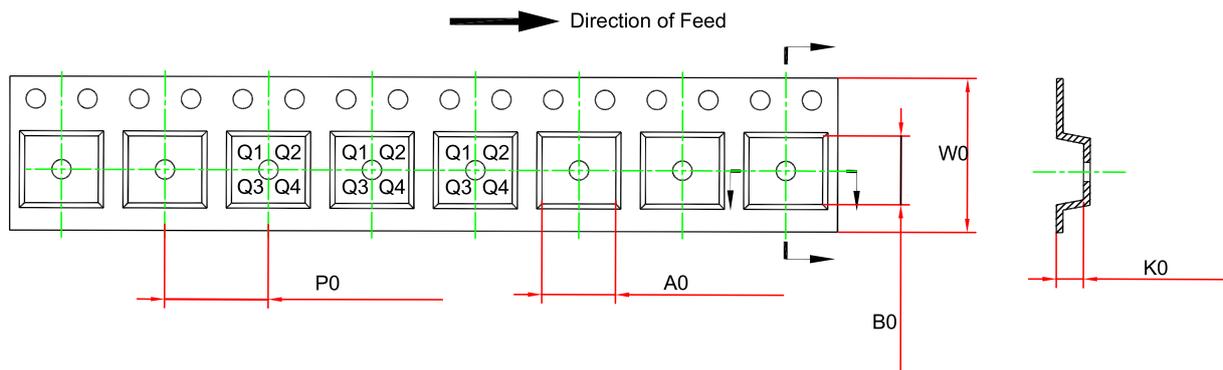
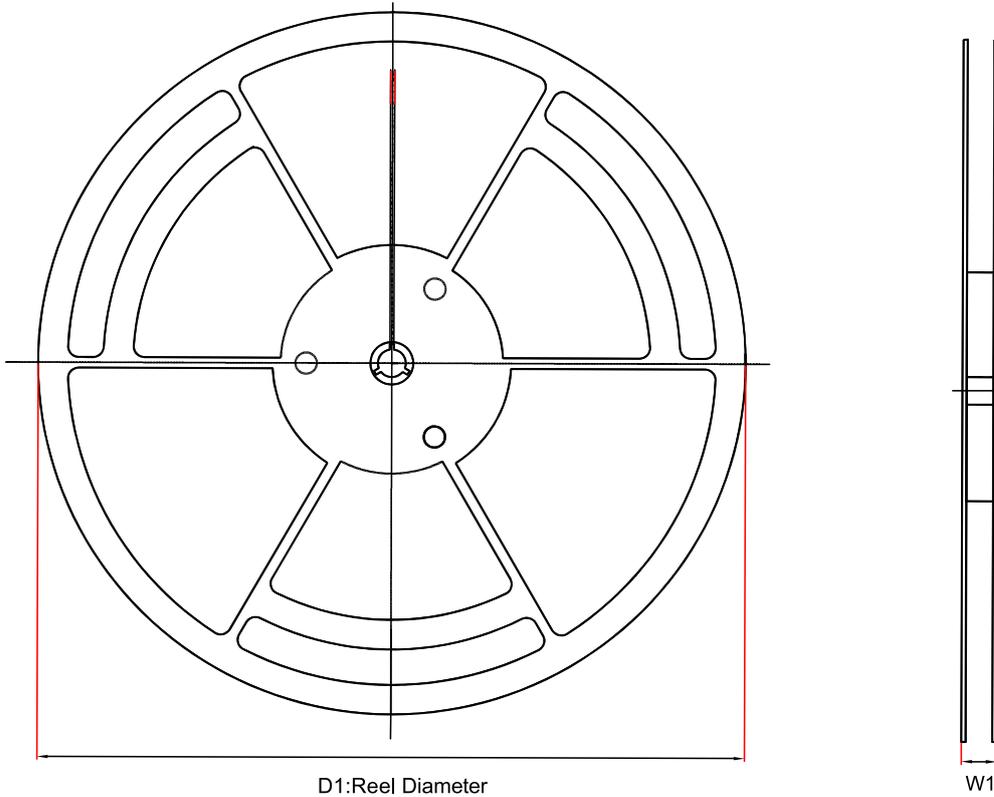


Figure 15. TPV706C Typical Application Circuit

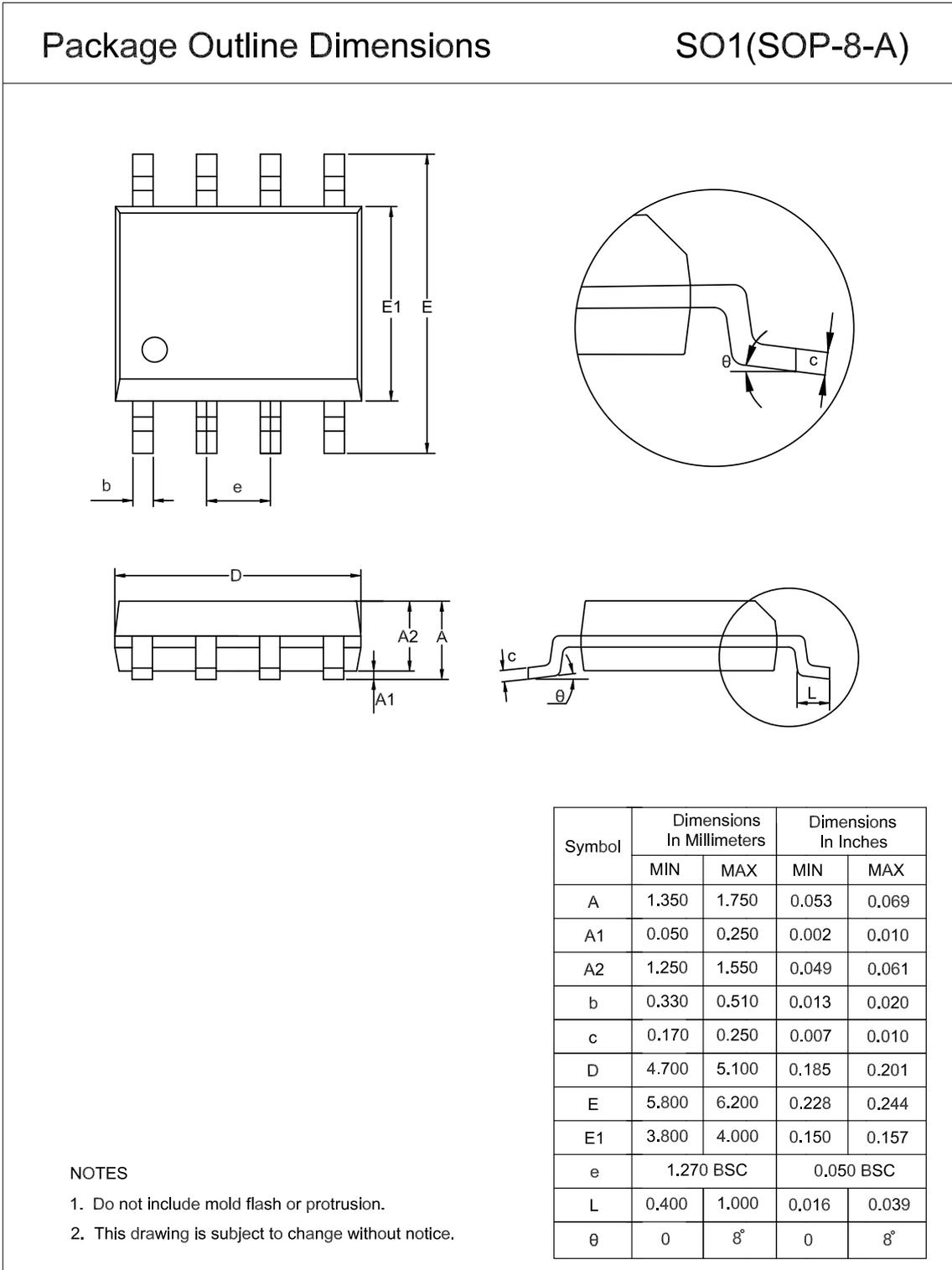
Tape and Reel Information



Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPV706CxL1-SR	SOP8	330	17.6	6.5	5.4	2	8	12	Q1

Package Outline Dimensions

SOP8



Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPV706CVL1-SR ⁽¹⁾	-40 to 125°C	SOP8	C6V	1	Tape and Reel, 4000	Green
TPV706CWL1-SR ⁽¹⁾	-40 to 125°C	SOP8	C6W	1	Tape and Reel, 4000	Green
TPV706CYL1-SR ⁽¹⁾	-40 to 125°C	SOP8	C6Y	1	Tape and Reel, 4000	Green
TPV706CZL1-SR ⁽¹⁾	-40 to 125°C	SOP8	C6Z	1	Tape and Reel, 4000	Green
TPV706CRL1-SR	-40 to 125°C	SOP8	C6R	1	Tape and Reel, 4000	Green
TPV706CSL1-SR	-40 to 125°C	SOP8	C6S	1	Tape and Reel, 4000	Green
TPV706CTL1-SR	-40 to 125°C	SOP8	C6T	1	Tape and Reel, 4000	Green
TPV706CML1-SR ⁽¹⁾	-40 to 125°C	SOP8	C6M	1	Tape and Reel, 4000	Green
TPV706CLL1-SR ⁽¹⁾	-40 to 125°C	SOP8	C6L	1	Tape and Reel, 4000	Green

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

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

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