

Failsafe Watchdog

Features

- Failsafe watchdog function: timeout warning after 1st timeout period, reset after 2nd timeout period, reset remains active to avoid further failures
- Standard timeout period and power-on reset time (10 ms), externally programmable if required
- V_{IN} monitoring with 3 standard or programmable trigger voltages for: power-on reset initialization, advanced power-fail warning (\overline{SAVE}), reset at power-down (\overline{RES})
- V_{DD} monitoring: power-on reset initialization enabled only if $V_{DD} \geq 3.5$ V
- Internal voltage reference
- Works down to 1.5 V supply voltage
- Push-pull or Open drain outputs
- Low current consumption
- Available for normal and extended temperature range
- DIP8 and SO8 package

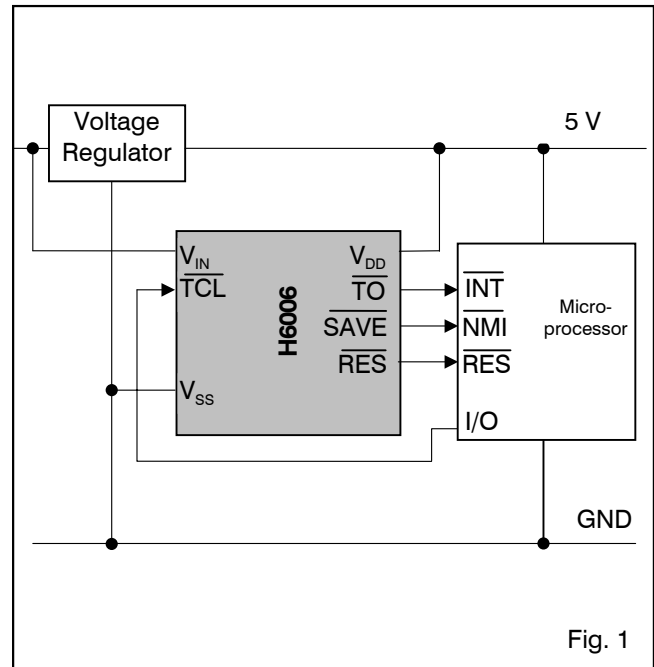
Description

The H6006 is a monolithic low power CMOS device combining a programmable digital timer and a series of voltage comparators on the same chip. The device is specially convenient for Watch-Dog functions such as microprocessor and supply voltage monitoring. The watchdog part is designed to be used in all applications where it is important that after the occurrence of a malfunction the microprocessor system is stopped to avoid further damage. The timeout warning signal (\overline{TO}) can be used to try to reactivate the system before halting it. The voltage monitoring part provides double security by combining both unregulated voltage and regulated voltage monitoring simultaneously. The H6006 initializes the power-on reset after V_{IN} reached V_{SH} and V_{DD} raises above 3.5 V. If V_{IN} drops below V_{SL} , the H6006 gives an advanced warning signal for register saving and if the voltage drops further below V_{RL} , \overline{RES} goes active. The H6006 functions at any supply voltage down to 1.5 V and is therefore particularly suited for start-up and shut-down control of microprocessor systems

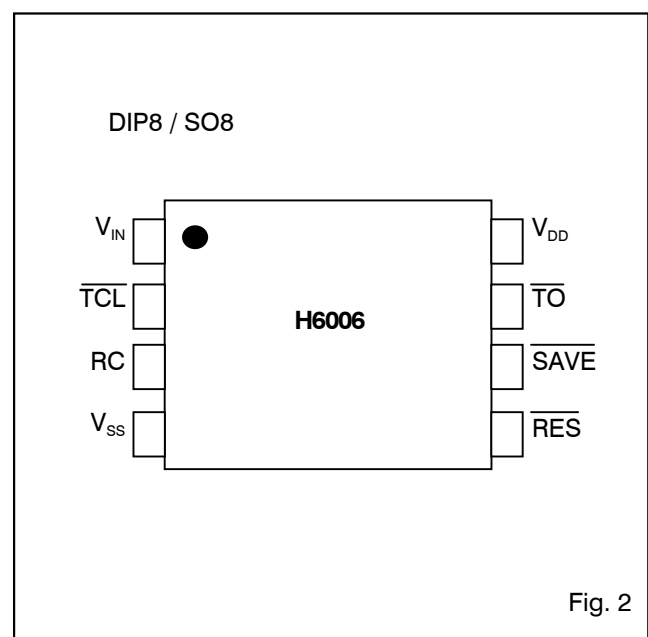
Applications

- Microprocessor and microcontroller systems
- Point of sales equipment
- Telecom products
- Automotive subsystems

Typical Operating Configuration



Pin Assignment





Absolute Maximum Ratings

Parameter	Symbol	Conditions
Voltage V_{DD} to V_{SS}	V_{DD}	-0.3 to +8 V
Voltage at any pin to V_{SS}	V_{MIN}	-0.3
Voltage at any pin to V_{DD} (except V_{IN})	V_{MAX}	+0.3
Voltage at V_{IN} to V_{SS}	V_{INMAX}	+15 V
Current at any output	I_{MAX}	± 10 mA
Storage temperature	T_{STO}	-65... +150 °C

Table 1

Stresses above these listed maximum ratings may cause permanent damage to the device. Exposure beyond specified operating conditions may affect device reliability or cause malfunction.

Handling Procedures

This device has built-in protection against high static voltages or electric fields; however, anti-static precautions must be taken as for any other CMOS component.

Electrical Characteristics

$V_{DD} = 5.0$ V, $T_A = -40$ to $+85$ °C, unless otherwise specified

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
V_{DD} activation threshold	V_{ON}	$T_A = 25$ °C	3		3.5	V
V_{DD} deactivation threshold	V_{OFF}	$T_A = 25$ °C		$V_{ON} - 1.5$		V
Supply current Input V_{IN} , TCL	I_{DD}	RC open, TCL= 5 V, $V_{IN} = 0$ V		50	140	μ A
Leakage current	I_{IP}	$V_{SS} \leq V_{IP} \leq V_{DD}$; $T_A = 85$ °C		0.005	1	μ A
Input current on pin V_{IN}	I_{IN}	Versions A1,B1; $V_{IN} = 10$ V		100	180	μ A
TCL input low level	V_{IL}				0.8	V
TCL input high level	V_{IH}		2.4			V
TO,SAVE,RES Outputs Leakage current	I_{OLK}	Versions A1, A2, A3; $V_{OUT} = V_{DD}$		0.05	1	μ A
Drive currents (all versions)	I_{OL}	$V_{OL} = 0.4$ V	3.2	8		mA
	I_{OL}	$V_{DD} = 3.5$ V; $V_{OL} = 0.4$ V	2			mA
	I_{OL}	$V_{DD} = 1.6$ V; $V_{OL} = 0.4$ V	80			μ A
Drive currents (versions B1, B2, B3) ¹⁾	I_{OH}	$V_{OH} = 4.0$ V	3.2	8		mA
	I_{OH}	$V_{DD} = 3.5$ V; $V_{OH} \geq 2.8$ V	2			mA
	I_{OH}	$V_{DD} = 1.6$ V; $V_{OH} = V_{DD} - 0.4$	80			μ A

¹⁾Versions: An = open drain outputs; Bn = push-pull outputs

Table 3

V_{IN} Surveillance

Voltage thresholds at $T_A = 25$ °C

Version ¹⁾	Comparator Reference	Input Resistance R_{VIN}	Thresholds	Threshold Tolerance	Ratio Tolerance ³⁾
A1, B1	V_{DD}	100k Ω	9.00 8.00 7.00 ²⁾	$\pm 5\%$	+2%
A2, B2	V_{DD}	~ 100 M Ω	2.25 2.00 1.75 ²⁾	$\pm 5\%$	+2%
A3, B3	Band-gap reference	~ 100 M Ω	2.00 1.95 1.90	$\pm 10\%$	+2%

¹⁾ Versions: An = open drain outputs; Bn = push-pull outputs

²⁾ at $V_{DD} = 5$ V

³⁾ Threshold ratio as V_{SH}/V_{SL} or V_{SL}/V_{RL}

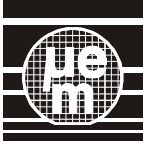
Table 4

Unless otherwise specified, proper operation can only occur when all terminal voltages are kept within the supply voltage range. Unused inputs must always be tied to a defined logic voltage level.

Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units
Operating temperature					
Industrial	T_{AI}	-40		+85	°C
Supply voltage	V_{DD}	1.5		5.5	V
Comparator input voltage					
Version A2, A3, B2,B3	V_{IN}	0		V_{DD}	V
Version A1,B1	V_{IN}	0		12	V
RC-oscillator programming (see Fig. 15)					
External capacitance	C1			100	nF
External resistance	R1	10			k Ω

Table 2



Timing Characteristics

$V_{DD} = 5.0\text{ V}$, $T_A = -40\text{ }^\circ\text{C}$ to $+85\text{ }^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Propagation delays						
$\overline{\text{TCL}}$ to output pins	T_{DIDO}			250	500	ns
V_{IN} to output pins	T_{AIDO}	Excluding debounce time T_{DB}		4	10	μs
Logic transition times on all output pins	T_{TR}	Load $10\text{ k}\Omega$, 100 pF		30	100	ns
Timeout period	T_{TO}	RC open, unshielded, $T_A = 25\text{ }^\circ\text{C}$	6	10	16	ms
	T_{TO}	RC open, unshielded (not tested)	4.5		20	ms
T_{TCL} input pulse width	T_{TCL}		150			ns
Power-on reset debounce	T_{DB}			$T_{\text{TO}/32}$		ms

Table 5

Timing Waveforms

Voltage Reaction: V_{DD} Monitoring

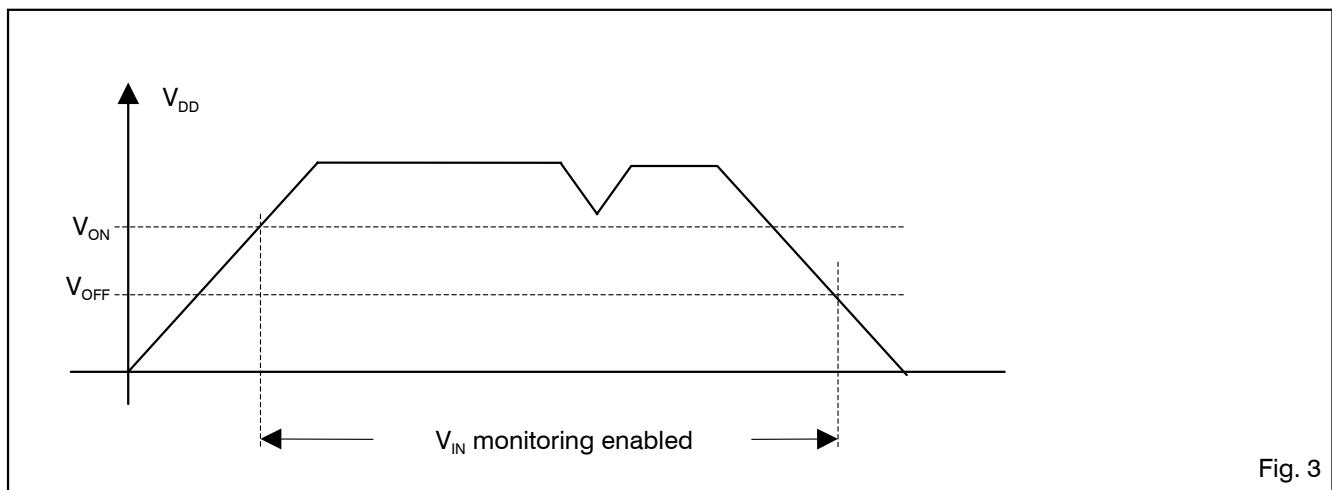


Fig. 3

Voltage Reaction: V_{IN} Monitoring

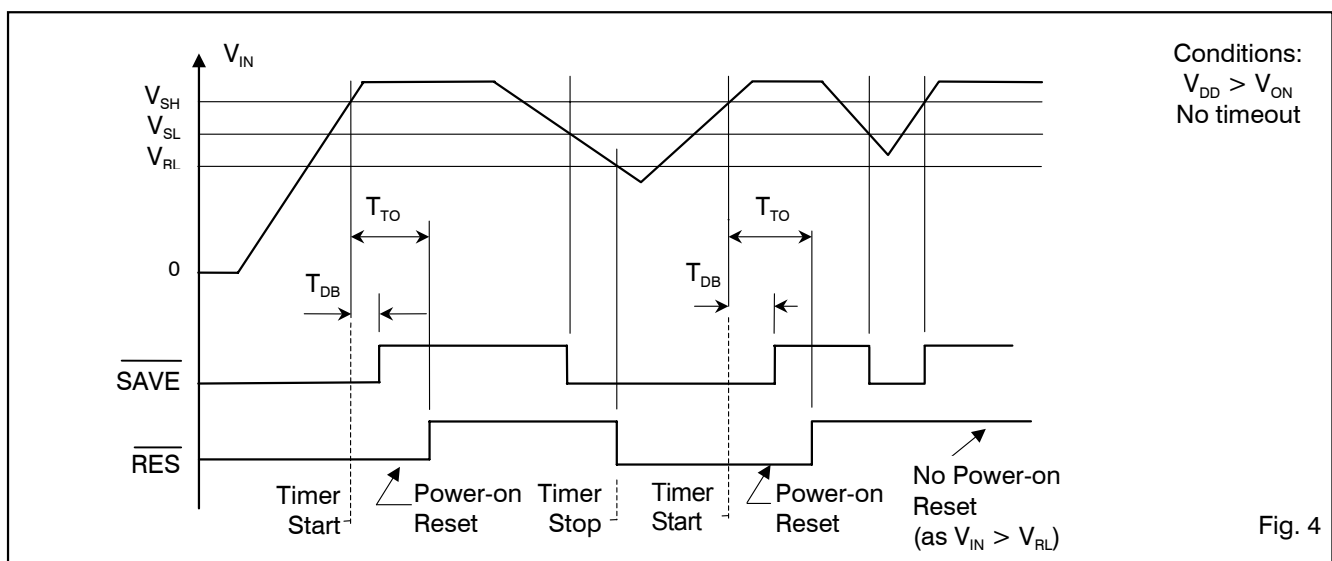
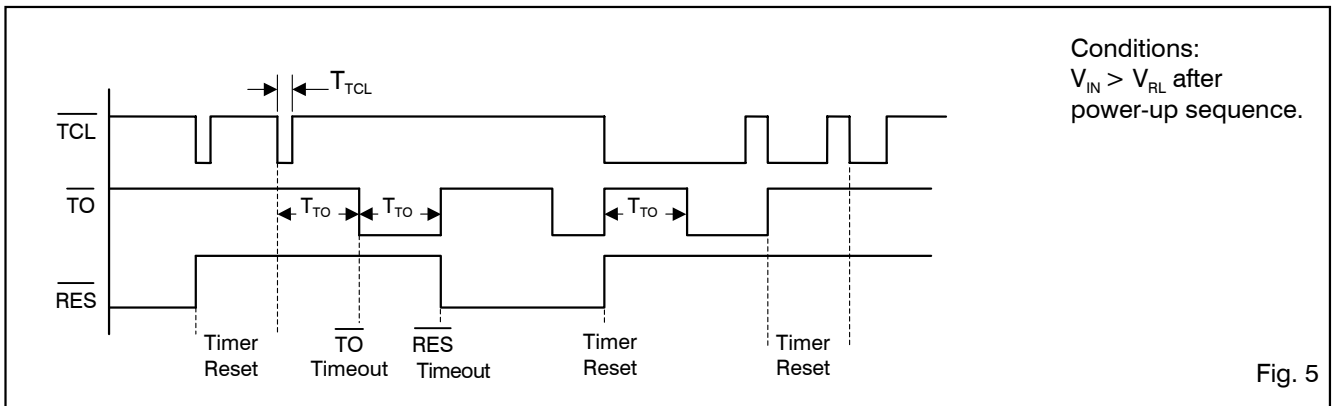


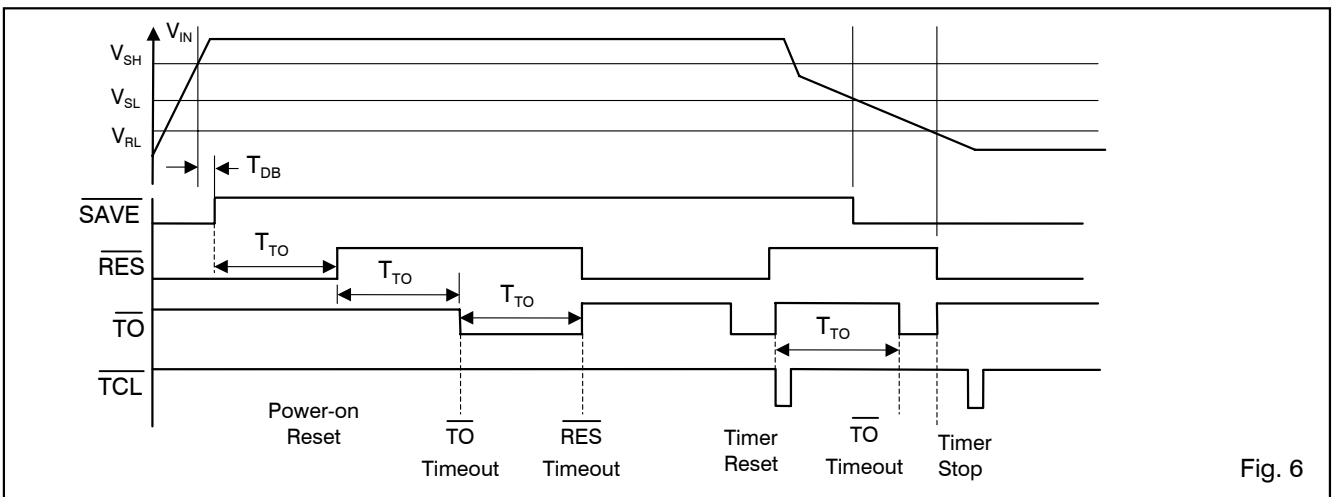
Fig. 4



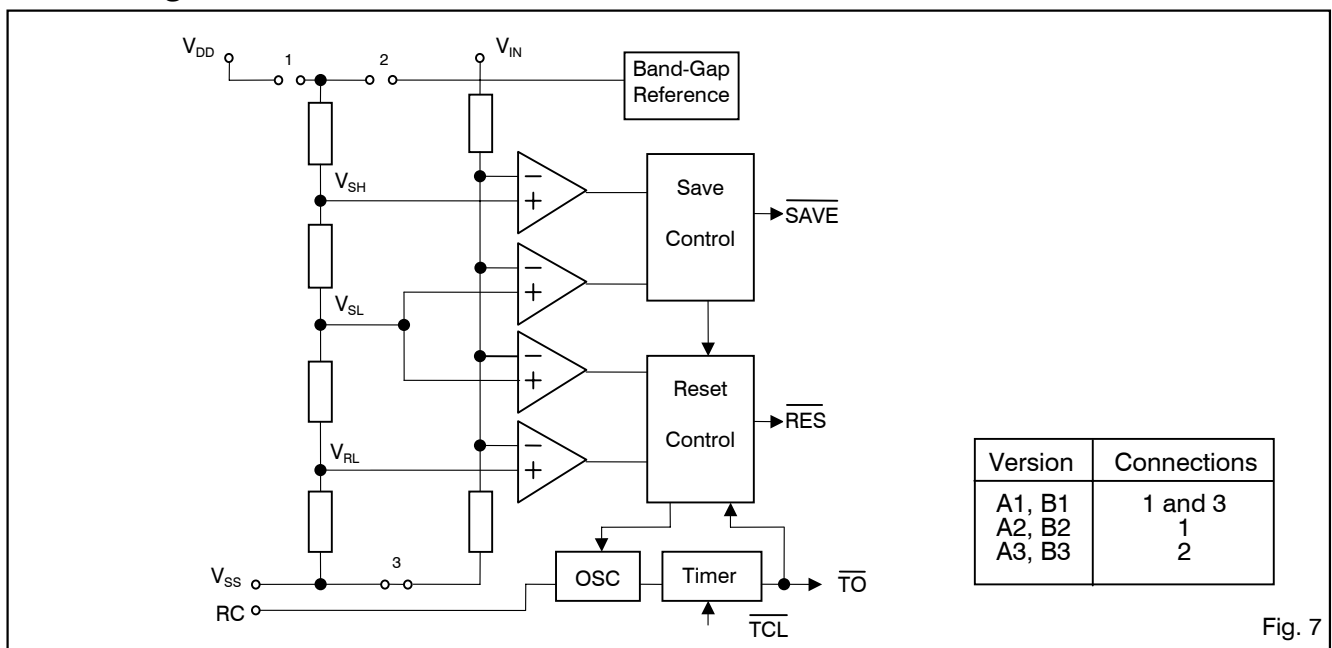
Timer Reaction



Combined Voltage and Timer Reaction



Block Diagram





Pin Description

Pin	Name	Function
1	V_{IN}	Voltage monitoring input
2	\overline{TCL}	Timer clear input signal
3	RC	RC oscillator tuning input
4	V_{SS}	GND terminal
5	\overline{RES}	Reset output
6	\overline{SAVE}	Save output
7	\overline{TO}	Timer output signal
8	V_{DD}	Positive supply voltage terminal

Table 6

Functional Description

Supply Lines

The circuit is powered through the V_{DD} and V_{SS} pins. It monitors both its own V_{DD} supply and a voltage applied to the V_{IN} input.

V_{DD} Monitoring

During power-up the V_{IN} monitoring is disabled and \overline{RES} and \overline{SAVE} stay active low as long as V_{DD} is below V_{ON} (3.5 V). As soon as V_{DD} reaches the V_{ON} level, the state of the outputs depend on the watchdog timer and the voltage at V_{IN} relative to the thresholds (see Fig. 3 and 4). If the supply voltage V_{DD} falls back below V_{OFF} (1.5 V) the watchdog timer and the V_{IN} monitoring are disabled and the outputs \overline{SAVE} and \overline{RES} are active low. The V_{DD} line should be free of spikes.

V_{IN} Monitoring

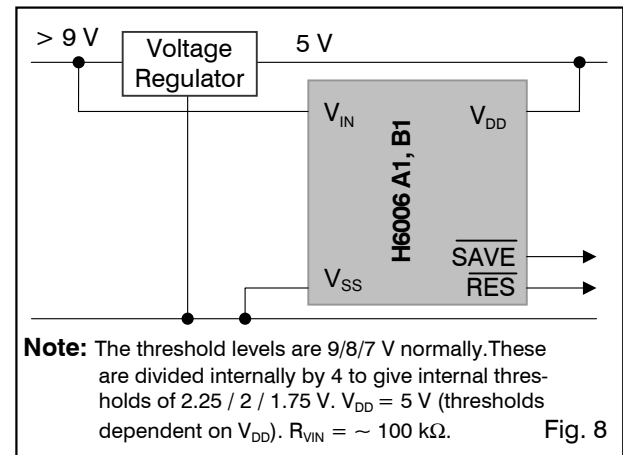
The analog voltage comparators compare the voltage applied to V_{IN} (typically connected to the input of the voltage regulator) with the stabilized supply voltage V_{DD} (versions A1, B1, A2, B2) or with the bandgap voltage (versions A3, B3) (see Fig. 7). At power-up, when V_{DD} reached V_{ON} and V_{IN} reaches the V_{SH} level, the \overline{SAVE} output goes high, and the timer starts running, setting \overline{RES} high after the time T_{TO} (see Fig. 4). If V_{IN} falls below V_{SL} , the \overline{SAVE} output goes low and stays low until V_{IN} rises again above V_{SH} . If V_{IN} falls below the voltage V_{RL} , the \overline{RES} output will go low and the on-chip timer will stop. When V_{IN} rises again above V_{SH} , the timer will initiate a power-up sequence. The \overline{RES} output may however be influenced independently of the voltage V_{IN} by the timer action, see section "Combined Voltage and Timer Action". Monitoring the rough DC side of the regulator as shown in Fig. 12 is the only way to have advanced warning at power-down. Spikes on V_{IN} should be filtered if they are likely to drop below V_{SL} .

The combination of V_{IN} and V_{DD} monitoring provide high system security: if V_{IN} rises much faster than V_{DD} , then the device starts the power-on sequence only when V_{DD} reached V_{ON} (Fig. 3). Short circuits on the regulated supply voltage can be detected.

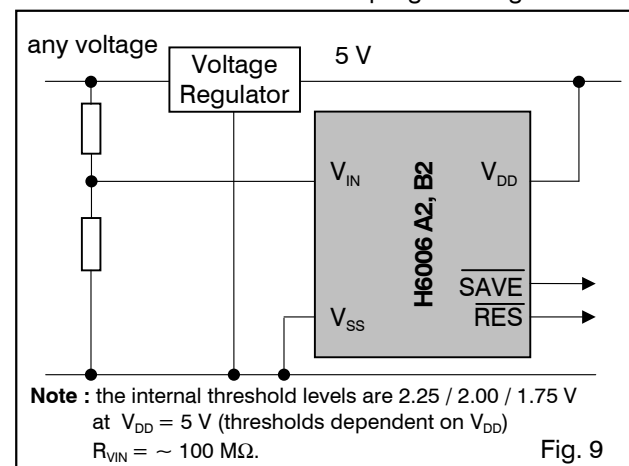
Voltage Thresholds on V_{IN}

The H6006 is available with 3 different sets of thresholds:

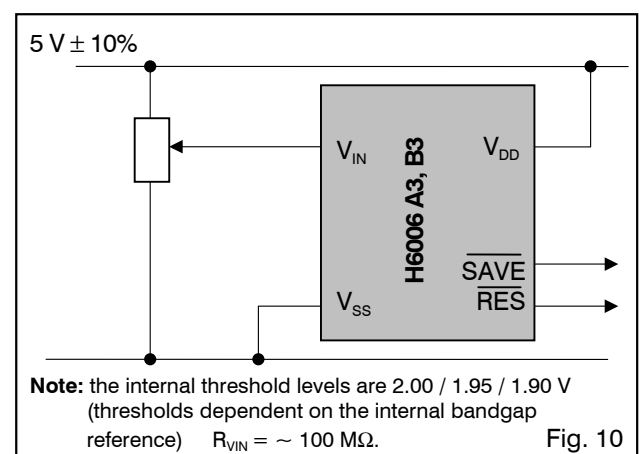
Version A1, B1: with internal voltage divider, resulting in thresholds for direct monitoring of the unregulated voltage without external components.



Version A2, B2: for monitoring of all unregulated voltage, where custom programming is required. Fixed resistor values can be used for programming.

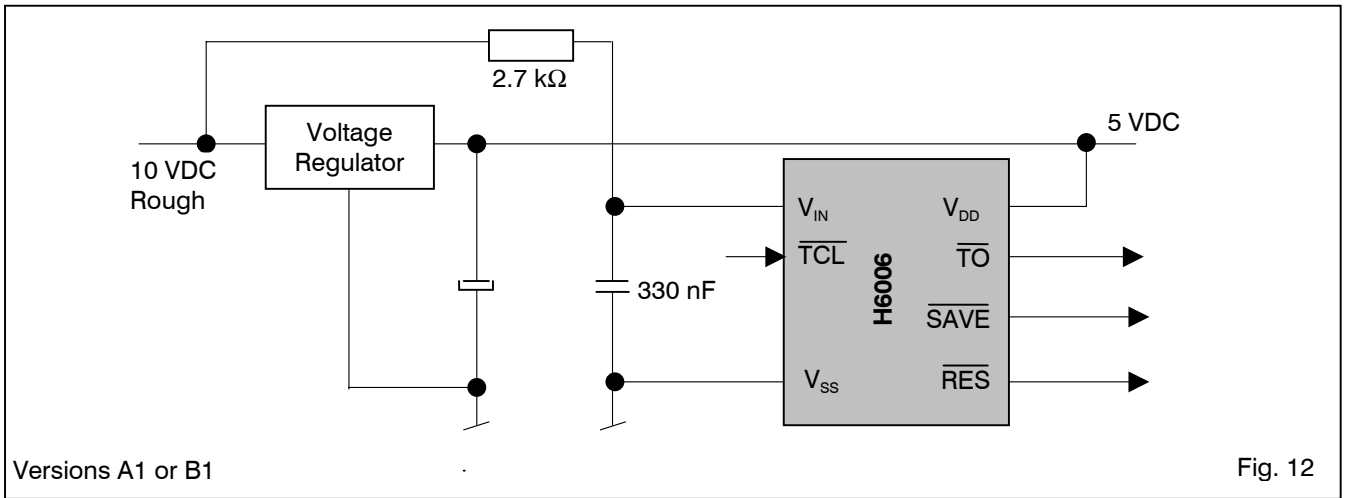


Version A3, B3: for monitoring of regulated voltage, where no unregulated voltage is available (the tolerance is $\pm 10\%$, see Table 4. For tighter tolerances, trimming can be used, see Fig. 10).

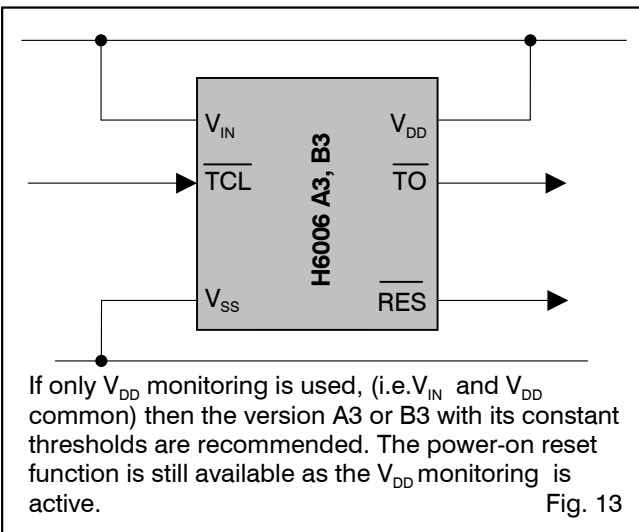




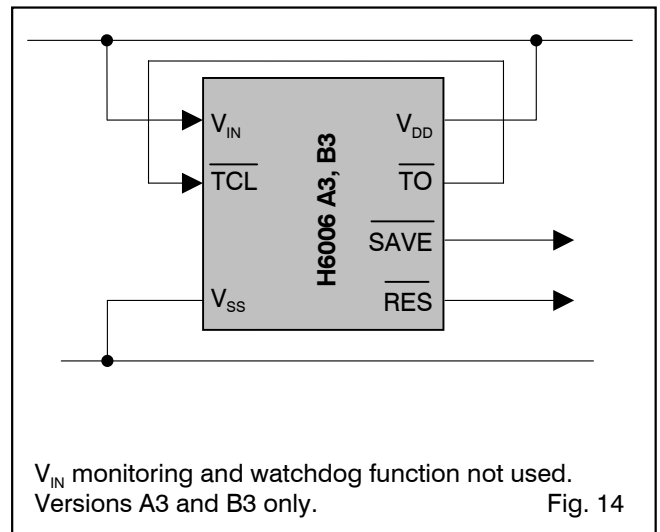
Voltage Monitor with Spike Suppression



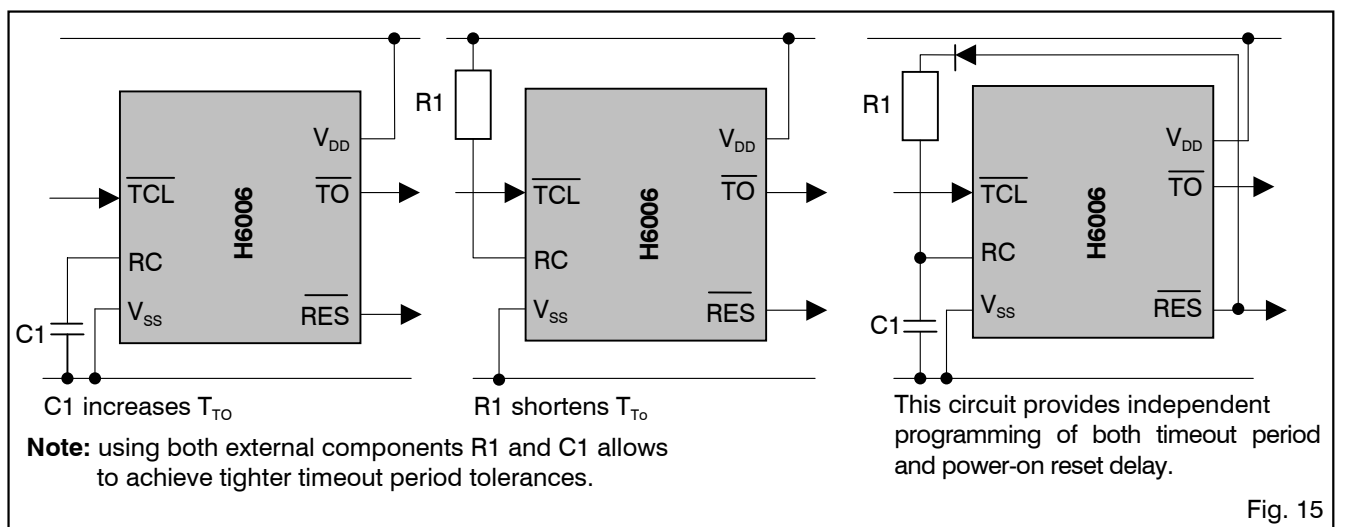
Watchdog and Power-On Reset



V_{DD} Monitoring and Power-On Reset



External Programming of RC Oscillator





Package Information

Dimensions of 8-Pin SOIC Package

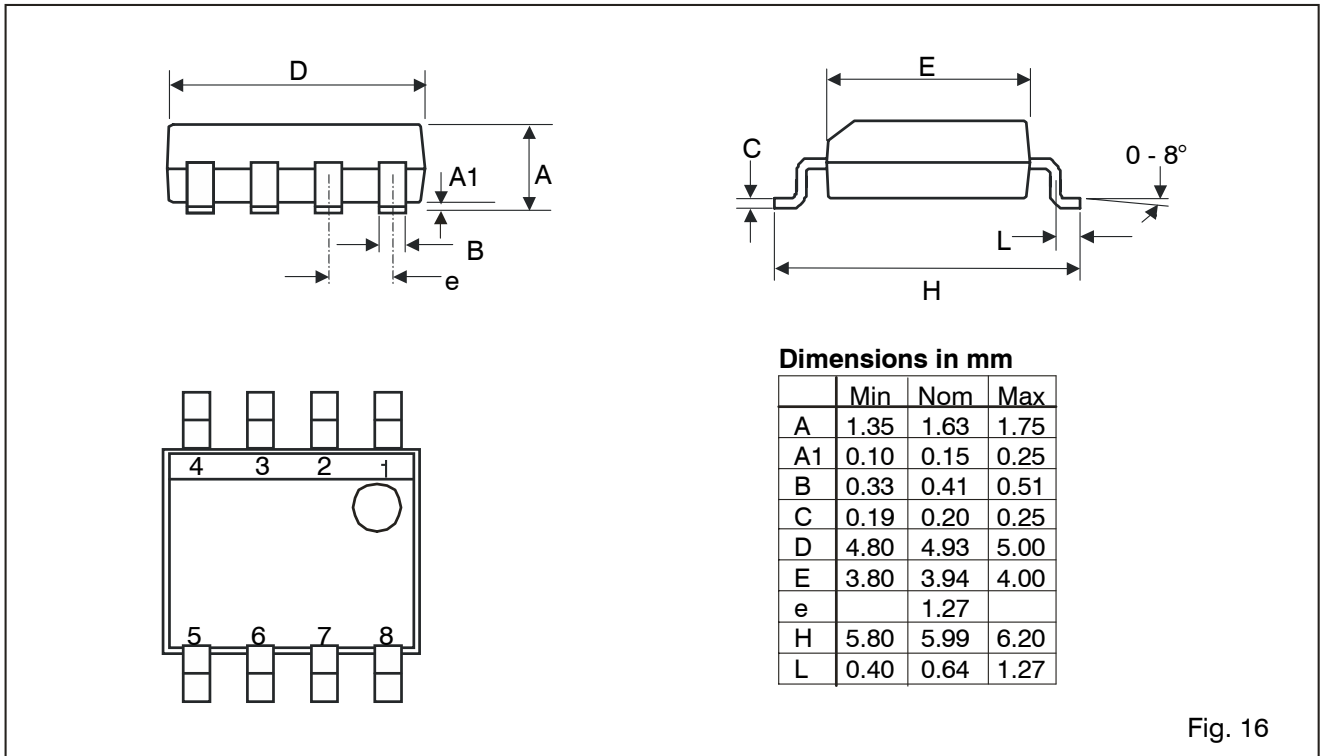


Fig. 16

Dimensions of 8-Pin Plastic DIP Package

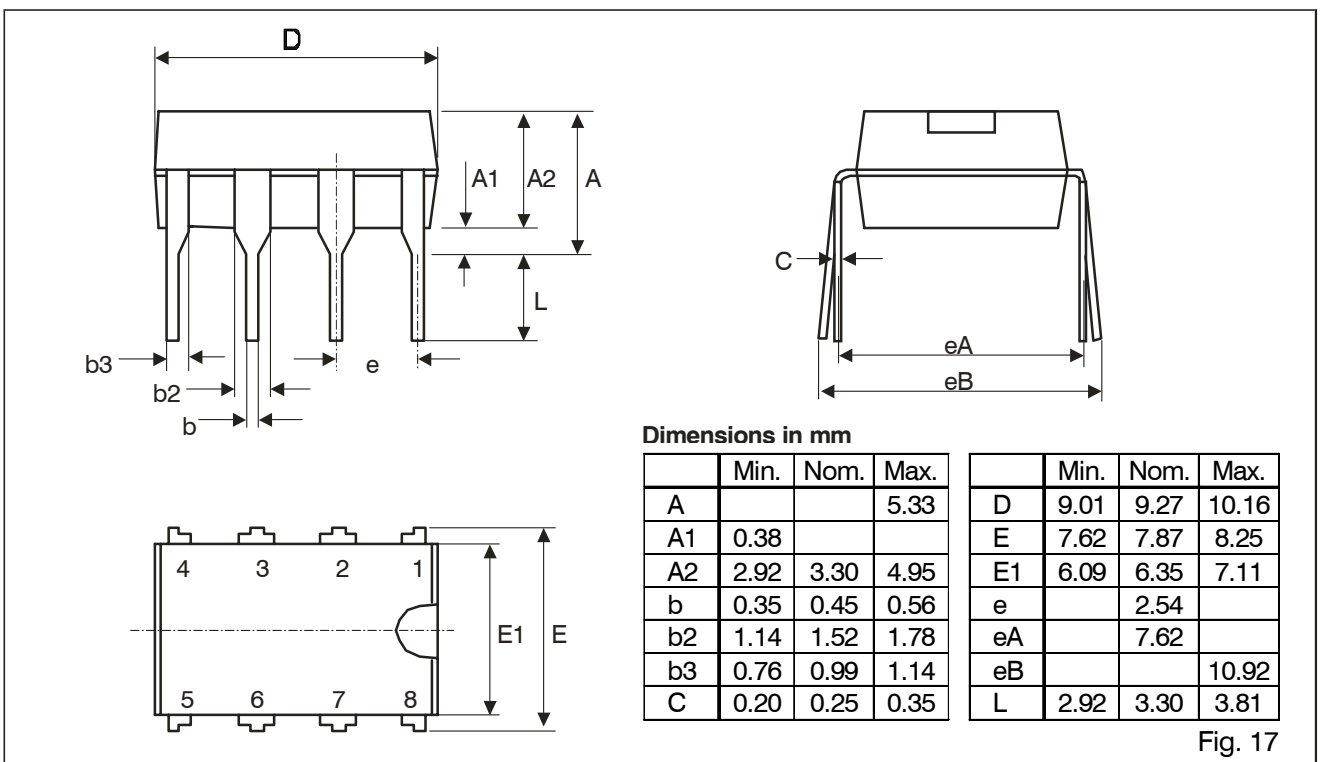
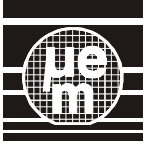


Fig. 17



Ordering Information

When ordering, please specify the complete Part Number

Part Number	Version	Threshold (see Table 4)	Output Type	Package	Delivery Form	Package Marking (first line)	Temperature Range
H6006A1SO8A*	A1	8.00	Open drain	8-pin SOIC	Stick	6006A1	-40 °C to +85 °C
H6006A1SO8B*				8-pin SOIC	Tape & Reel	6006A1	
H6006A1DL8A*				8-pin plastic DIP	Stick	H6006A1	
H6006A2SO8A	A2	2.00		8-pin SOIC	Stick	6006A2	
H6006A2SO8B				8-pin SOIC	Tape & Reel	6006A2	
H6006A2DL8A				8-pin plastic DIP	Stick	H6006A2	
H6006A3SO8A*	A3	1.95		8-pin SOIC	Stick	6006A3	
H6006A3SO8B*				8-pin SOIC	Tape & Reel	6006A3	
H6006A3DL8A				8-pin plastic DIP	Stick	H6006A3	
H6006B1SO8A	B1	8.00	Push- pull	8-pin SOIC	Stick	6006B1	
H6006B1SO8B*				8-pin SOIC	Tape & Reel	6006B1	
H6006B1DL8A*				8-pin plastic DIP	Stick	H6006B1	
H6006B2SO8A	B2	2.00		8-pin SOIC	Stick	6006B2	
H6006B2SO8B				8-pin SOIC	Tape & Reel	6006B2	
H6006B2DL8A*				8-pin plastic DIP	Stick	H6006B2	
H6006B3SO8A	B3	1.95		8-pin SOIC	Stick	6006B3	
H6006B3SO8B				8-pin SOIC	Tape & Reel	6006B3	
H6006B3DL8A				8-pin plastic DIP	Stick	H6006B3	

* = non stock item. Might be available on request and upon minimum order quantity (please contact EM Microelectronic).

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