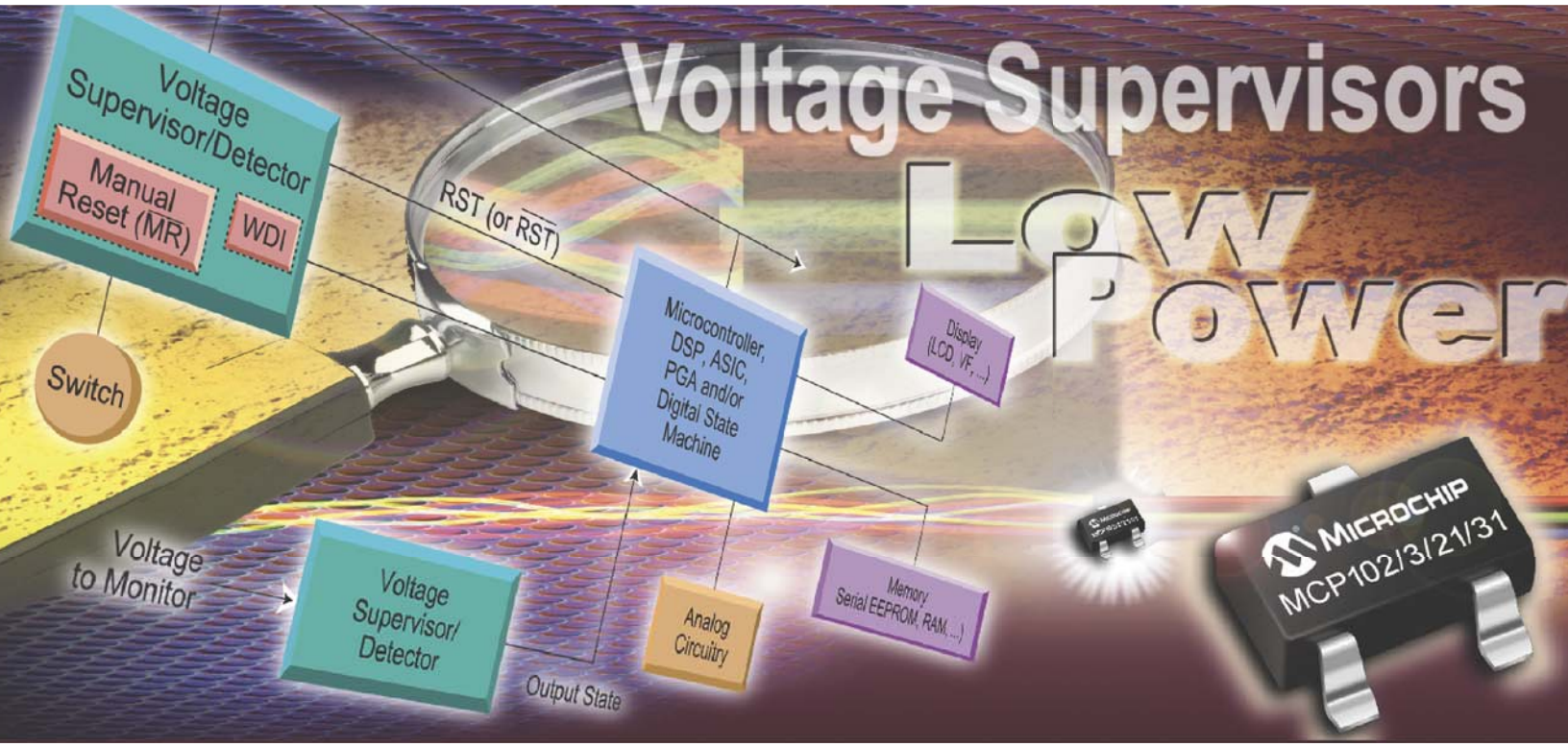
MICROCHIP

Voltage Supervisors Design Guide

A Wide Range of Voltage Supervisors and Voltage Detectors Give System Designers Many Options for Creating High-Reliability Systems



Design ideas in this guide use the following devices. A complete device list and corresponding data sheets for these products can be found at **www.microchip.com**

Voltage Supervisors:

MCP100/101/102/103
MCP111/112
MCP120/121
MCP130/131
MCP809/810
MCP1316/17/18/19/20/21/22
MCP1316M/18M/19M
TC1232
TC127X/TC1272A
TC32M
TC51/52
TC53C/53N
TC54VC/TC54VN
TCM809/810/811/812

Voltage Supervisors – Overview

The wide range of Microchip's family of Voltage Supervisors and Voltage Detectors gives the system designers many options for the creation of high-reliability systems.

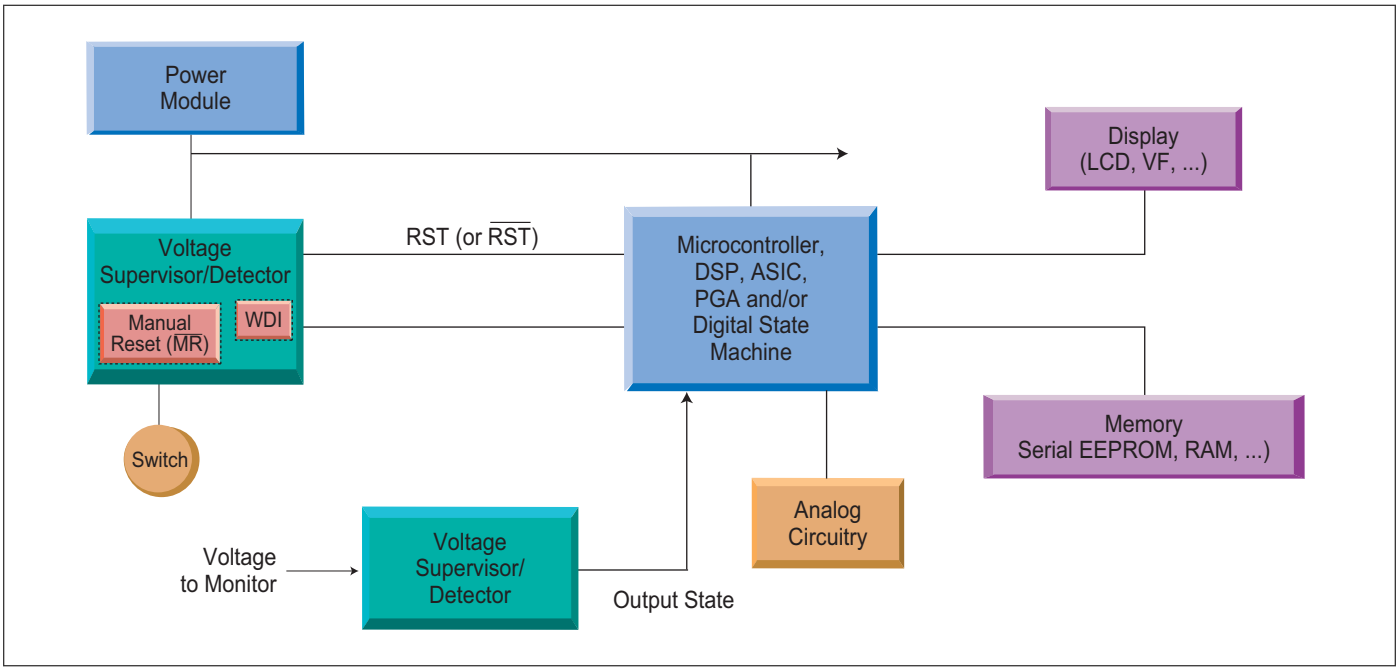
To ease the system designer's implementation, Microchip offers a wide range of voltage trip points, output driver options, power consumption, package options, output delays, Watchdog Timer functions and other features (such as Manual Reset inputs).

The Voltage Supervisor/Detector outputs a signal that can be used by the system in different ways. The output can be use to place the system (or part of the system) in the reset state or can be used as a control signal indicating the state (< or >) of the voltage at a particular node determined by the device trip point.

The Watchdog Timer function can be used to increase system reliability, by helping to detect unintended program flow execution.

The Manual Reset input pin, allows a push button reset switch to be added to the system without additional external components.

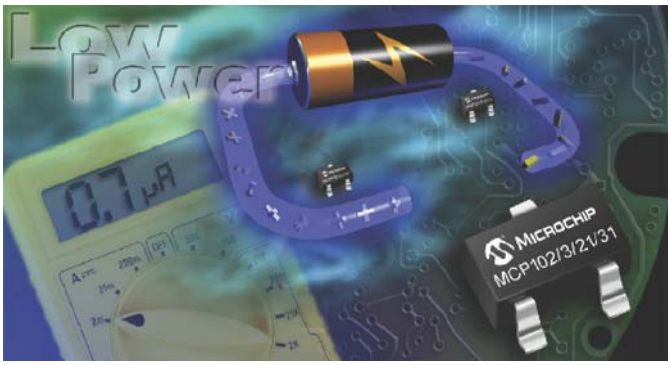
System Overview Block Diagram



Low Power Applications

Many applications are very power sensitive. Typically these are battery powered applications. These applications still require the protection of a voltage supervisory device, but in many cases this reduces the operational time of the application, or the designer removes this protection from the application (due to budget constraints).

Microchip's Voltage Supervisory family has several devices that are in the low μA and sub μA range (typical). This allows these devices to be implemented to maintain the system reliability with minimal impact to the system current.



Product Specifications

Device	Reset Output A(3)			Reset Output B(3)			Voltage Trip Points (V) (min/max)		Reset Delay (ms) (min/max)		WDT Input	WDT Period (ms) (min/max)		MR Input	IDD (μA) (Typ/Max)	Packages
	Type	Pull-up Resistor	Active Level	Type	Pull-up Resistor	Active Level	Std.	Other Available(1)	Std.	Other Available(1)		Std.	Other Available(1)			
MCP102	Push-Pull	–	Low	–	–	–	1.85/1.95, 2.26/2.4, 2.56/2.7, 2.85/3.0, 3.0/3.16, 4.27/4.5, 4.51/4.75	–	–	–		180	–	–	<1/1.75(1)	3SOT-23 3SC-70 3TO-92
MCP103	Push-Pull	–	Low	–	–	–	1.85/1.95, 2.26/2.4, 2.56/2.7, 2.85/3.0, 3.0/3.16, 4.27/4.5, 4.51/4.75	–	–	–		180	–	–	<1/1.75(1)	3SOT-23 3SC-70
MCP111	Open-Drain	External	Low	–	–	–	1.85/1.95, 2.26/2.4, 2.56/2.7, 2.82/2.98, 2.85/3.0, 3.0/3.16, 4.27/4.5, 4.51/4.75	–	–	–		–	–	–	<1/1.75	3SOT-23 3SC-70 3TO-92
MCP112	Push-Pull	–	Low	–	–	–	1.85/1.95, 2.26/2.4, 2.56/2.7, 2.82/2.98, 2.85/3.0, 3.0/3.16, 4.27/4.5, 4.51/4.75	–	–	–		–	–	–	<1/1.75	3SOT-23 3SC-70 3TO-92
MCP121	Open-Drain	External	Low	–	–	–	1.85/1.95, 2.26/2.4, 2.56/2.7, 2.85/3.0, 3.0/3.16, 4.27/4.5, 4.51/4.75	–	–	–		180	–	–	<1/1.75(1)	3SOT-23 3SC-70 3TO-92
MCP131	Open-Drain	Internal	Low	–	–	–	1.85/1.95, 2.26/2.4, 2.56/2.7, 2.85/3.0, 3.0/3.16, 4.27/4.5, 4.51/4.75	–	–	–		180	–	–	<1/1.75(1,2)	3SOT-23 3SC-70 3TO-92
MCP1316	Push-Pull	–	Low	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/ 2240	Yes	1120/ 2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	5SOT-23
MCP1316M	Open-Drain	Internal	Low	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/ 2240	Yes	1120/ 2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	5SOT-23
MCP1317	Push-Pulln	–	High	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/ 2240	Yes	1120/ 2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	5SOT-23
MCP1318	Push-Pull	–	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/ 2240	Yes	1120/ 2240	4.3/9.3, 71/153, 17900/38400	–	1/10	5SOT-23
MCP1318M	Open-Drain	Internal	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/ 2240	Yes	1120/ 2240	4.3/9.3, 71/153, 17900/38400	–	1/10	5SOT-23

1. There is additional current when the Reset Delay timer is active. This is not the typical state.
2. There is additional current when the RST pin is driving low, due to the internal pull-up resistor.
3. There are some devices that have more than one Reset Output. This output may be the compliment of Reset Output A, may be a different output type or an output from a different Trip Point.

Low Power Applications (Continued)

Product Specifications

Device	Reset Output A[3]			Reset Output B[3]			Voltage Trip Points (V) (min/max)		Reset Delay (ms) (min/max)		WDT Input	WDT Period (ms) (min/max)		MR Input	IDD (µA) (Typ/ Max)	Packages
	Type	Pull-up Resistor	Active Level	Type	Pull-up Resistor	Active Level	Std.	Other Available[1]	Std.	Other Available[1]		Std.	Other Available[1]			
MCP1319	Push-Pull	–	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/ 2240	–	–	–	Yes	1/10	5SOT-23
MCP1319M	Open-Drain	Internal	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/ 2240	–	–	–	Yes	1/10	5SOT-23
MCP1320	Open-Drain	External	Low	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/ 2240	Yes	1120/ 2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	5SOT-23
MCP1321	Open-Drain	External	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/ 2240	Yes	1120/ 2240	4.3/9.3, 71/153, 17900/38400	–	1/10	5SOT-23
MCP1322	Open-Drain	External	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/ 2240	–	–	–	Yes	1/10	5SOT-23
TC1270	Push-Pull	–	Low	–	–	–	4.5/4.75, 4.25/4.5, 3.0/3.15, 2.85/3.0, 2.55/2.7, 1.7/1.8	–	140/560	–	–	–	–	Yes	7/15	4SOT-143
TC1271	Push-Pull	–	High	–	–	–	4.5/4.75, 4.25/4.5, 3.0/3.15, 2.85/3.0, 2.55/2.7, 1.7/1.8	–	140/560	–	–	–	–	Yes	7/15	4SOT-143
TCM811	Push-Pull	–	Low	–	–	–	4.5/4.75, 4.25/4.5, 3.0/3.15, 2.85/3.0, 2.55/2.7, 1.7/1.8	–	140/560	–	–	–	–	Yes	6/15	4SOT-143
TCM812	Push-Pull	–	High	–	–	–	4.5/4.75, 4.25/4.5, 3.0/3.15, 2.85/3.0, 2.55/2.7, 1.7/1.8	–	140/560	–	–	–	–	Yes	6/15	4SOT-143
TC51	Open-Drain	External	Low	–	–	–	2.16/2.24, 2.65/2.75, 2.94/3.06	1.6 to 6.0 (every 100 mV)	50/200	–	–	–	–	–	2.0/4.2	3SOT-23
TC52	Open-Drain	External	Low	Open-Drain	External	Low	2.94/3.06 (2.65/2.75), 4.41/4.59 (2.65/2.75)	1.6 to 5.0 (every 100 mV)	–	–	–	–	–	–	3.0/6.3	5SOT-23
TC53C	Push-Pull	–	Low	–	–	–	2.16/2.24, 2.65/2.75, 2.84/2.96	1.6 to 6.0 (every 100 mV)	–	–	–	–	–	–	2.0/4.2	5SOT-23
TC53N	Open-Drain	External	Low	–	–	–	2.16/2.24, 2.65/2.75, 2.84/2.96	1.6 to 6.0 (every 100 mV)	–	–	–	–	–	–	2.0/4.2	5SOT-23
TC54VC	Push-Pull	–	Low	–	–	–	1.37/1.43, 2.06/2.14, 2.65/2.75, 2.84/2.96, 2.94/3.06, 4.12/4.28, 4.21/4.39, 7.55/7.85	1.4 to 7.7 (every 100 mV)	–	–	–	–	–	–	1.1/3.6	3SOT-23 5SOT-23 3SOT-89 3T0-92
TC54VN	Open-Drain	External	Low	–	–	–	1.37/1.43, 2.06/2.14, 2.65/2.75, 2.84/2.96, 2.94/3.06, 4.12/4.28, 4.21/4.39, 7.55/7.85	1.4 to 7.7 (every 100 mV)	–	–	–	–	–	–	1.1/3.6	3SOT-23 5SOT-23 3SOT-89 3T0-92
TCM811	Push-Pull	–	Low	–	–	–	4.5/4.75, 4.25/4.5, 3.0/3.15, 2.85/3.0, 2.55/2.7, 1.7/1.8	–	140/560	–	–	–	–	Yes	6/15	4SOT-143
TCM812	Push-Pull	–	High	–	–	–	4.5/4.75, 4.25/4.5, 3.0/3.15, 2.85/3.0, 2.55/2.7, 1.7/1.8	–	140/560	–	–	–	–	Yes	6/15	4SOT-143

1. There is additional current when the Reset Delay timer is active. This is not the typical state.
2. There is additional current when the RST pin is driving low, due to the internal pull-up resistor.
3. There are some devices that have more than one Reset Output. This output may be the compliment of Reset Output A, may be a different output type or an output from a different Trip Point.

Watchdog Timer Applications

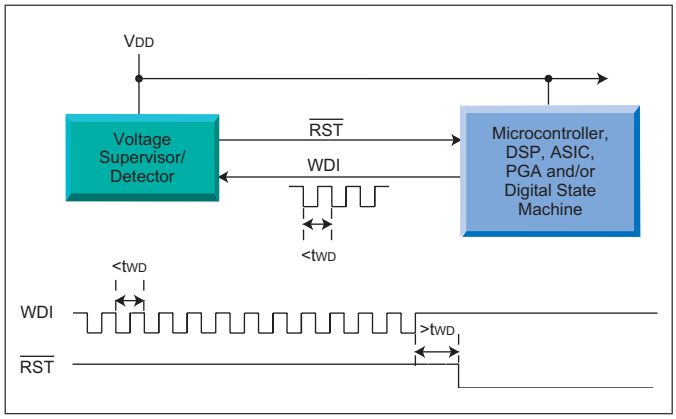
Applications may desire an external Watchdog function to help detect if the embedded program execution is not operating as expected.

This is done by requiring the embedded controller to "pet" the Watchdog within a predetermined time frame. If the device is not "petted" within this time frame (TWD), the device forces the reset signal active. The figure shows the WDI waveform of the microcontroller and the corresponding $\overline{RST}$ pin waveform.

When selecting a Watchdog time-out, the TWD minimum time should be long enough that the microcontroller will cause the transition before this period expires. This means that for the expected program flow, the program must return to the Watchdog code segment that "pets" the Watchdog before the minimum TWD time.

If unintended program flow (operation) occurs, it is unlikely that Watchdog code segment will be executed. So after the TWD maximum time occurs, the voltage supervisor will be driving the $\overline{RST}$ pin low. The TWD maximum time must be selected so that damage to the application system will not occur.

Watchdog and $\overline{RST}$ Waveforms



Product Specifications

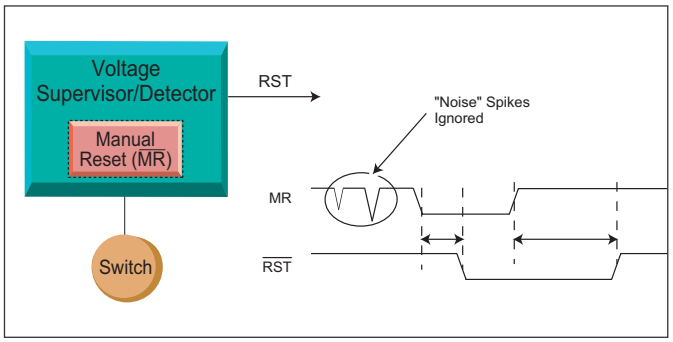
Device	Reset Output A			Reset Output B			Voltage Trip Points (V) (min/max)		Reset Delay (ms) (min/max)		WDT Period (ms) (min/max)		MR Input	IDD (µA) (Typ/Max)	Packages
	Type	Pull-up Resistor	Active Level	Type	Pull-up Resistor	Active Level	Std.	Other Available(1)	Std.	Other Available(1)	Std.	Other Available(1)			
MCP1316	Push-Pull	–	Low	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	1120/2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	5SOT-23
MCP1316M	Open-Drain	Internal	Low	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	1120/2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	5SOT-23
MCP1317	Push-Pulln	–	High	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	1120/2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	5SOT-23
MCP1318	Push-Pull	–	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	1120/2240	4.3/9.3, 71/153, 17900/38400	–	1/10	5SOT-23
MCP1318M	Open-Drain	Internal	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	1120/2240	4.3/9.3, 71/153, 17900/38400	–	1/10	5SOT-23
MCP1320	Open-Drain	External	Low	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	1120/2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	5SOT-23
MCP1321	Open-Drain	External	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	1120/2240	4.3/9.3, 71/153, 17900/38400	–	1/10	5SOT-23
TC1232	Open-Drain	External	Low	–	–	–	4.25/4.5, 4.5/4.75	–	250/ 1000	–	62.5/250, 250/1000, 500/2000	–	Yes	50/200	8PDIP 8SOIC 16SOIC
TC32M	Open-Drain	External	Low	–	–	–	4.25/4.5	–	500/900	–	500/900	–	–	50/200	4SOT-223 3T0-92

1. Please contact Microchip sales for additional information. Minimum order quantities required.

Manual Reset

Some applications may require an external manual reset. Microchip provides a number of voltage supervisor solutions that have a manual Reset ($\overline{MR}$) pin to ease this implementation. The input into the Manual Reset pin is filtered to reject noise. When the Manual Reset pin is in the active state for the required time, the Reset pin is driven low. The Reset pin will be held low for the Reset Delay Time (T_{RST}).

Manual Reset Waveform



Product Specifications

Device	Reset Output A			Reset Output B			Voltage Trip Points (V) (min/max)		Reset Delay (ms) (min/max)		WDT Input	WDT Period (ms) (min/max)		IDD (µA) (Typ/Max)	Packages
	Type	Pull-up Resistor	Active Level	Type	Pull-up Resistor	Active Level	Std.	Other Available(1)	Std.	Other Available(1)		Std.	Other Available(1)		
MCP1316	Push-Pull	–	Low	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	1/10	5SOT-23
MCP1316M	Open-Drain	Internal	Low	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	1/10	5SOT-23
MCP1317	Push-Pulln	–	High	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	1/10	5SOT-23
MCP1319	Push-Pull	–	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	–	–	–	1/10	5SOT-23
MCP1319M	Open-Drain	Internal	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	–	–	–	1/10	5SOT-23
MCP1320	Open-Drain	External	Low	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	1/10	5SOT-23
MCP1322	Open-Drain	External	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	–	–	–	1/10	5SOT-23
TC1232	Open-Drain	External	Low	–	–	–	4.25/4.5, 4.5/4.75	–	250/1000	–	Yes	62.5/250, 250/1000, 500/2000	–	50/200	8PDIP 8SOIC 16SOIC
TC1270	Push-Pull	–	Low	–	–	–	4.5/4.75, 4.25/4.5, 3.0/3.15, 2.85/3.0, 2.55/2.7, 1.7/1.8	–	140/560	–	–	–	–	7/15	4SOT-143
TC1271	Push-Pull	–	High	–	–	–	4.5/4.75, 4.25/4.5, 3.0/3.15, 2.85/3.0, 2.55/2.7, 1.7/1.8	–	140/560	–	–	–	–	7/15	4SOT-143
TCM811	Push-Pull	–	Low	–	–	–	4.5/4.75, 4.25/4.5, 3.0/3.15, 2.85/3.0, 2.55/2.7, 1.7/1.8	–	140/560	–	–	–	–	6/15	4SOT-143
TCM812	Push-Pull	–	High	–	–	–	4.5/4.75, 4.25/4.5, 3.0/3.15, 2.85/3.0, 2.55/2.7, 1.7/1.8	–	140/560	–	–	–	–	6/15	4SOT-143

1. Please contact Microchip sales for additional information. Minimum order quantities required.

High Voltage Open Drain Outputs (ICSP™ Applications)

PICmicro® microcontrollers allow their program memory to be programmed while the device is in the application. This mode is called In-Circuit Serial Programming™ (ICSP™). ICSP can be used to program the device after assembly as well as for firmware updates in the field.

In most cases, entering the ICSP mode requires that the $\overline{MCLR}$ pin to go from a low voltage (V_{IL}) to the programming high voltage (V_{IHH}). The V_{IHH} is dependent on the PICmicro device and is typically ranges from a minimum of the PICmicro MCU's V_{DD} + 3.5V to a maximum of 14V.

The figure below shows a typical microcontroller-voltage supervisor system circuit with this in-line resistance (R_S). R_{PU} is the $\overline{MCLR}$ pull-up resistor, R_S is the in-line resistor to the Open Drain output of the Voltage Supervisor or Voltage Detector. V_{RS} is the voltage into the $\overline{MCLR}$ pin.

Although PICmicro MCUs offer internal brown out protection, there may be applications reasons why it is better to use an external device. The two main reasons are:

1. Desired voltage trip point
2. System current consumption

The table below shows the trip point options and their associated maximum current specification between some PICmicro MCU's and the dedicated voltage supervisor/detector devices.

Reset Characteristics

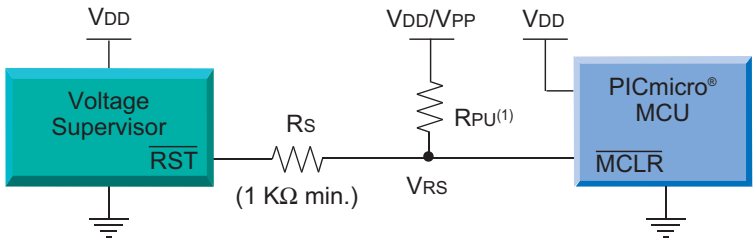
Device	Trip Point Voltages (V) (Typ.)	Operating Current (µA) (min./max.)
PIC16F87XA	4.00	–/200(1)
PIC18F1320	2.72, 4.22, 4.54	19/45(1)
MCP121	1.90, 2.32, 2.63, 2.93, 3.08, 4.38, 4.63	–/1.75(2)
MCP111	1.90, 2.32, 2.63, 2.90, 2.93, 3.08, 4.38, 4.63	–/1.75(2)
MCP13XX	2.9, 4.6 (custom order every 100 mV between 2.0V and 4.7V)	–/2(3)

Note 1: This current added to either device I_{DD} or I_{PD} current.
2: Power-up Timer Active current is 20 mA. This is not the typical state.
3: Reset Delay Timer and Watchdog Timer Active current is 10 mA. This is not the typical state.

Not all applications require the use of an external voltage supervisor solution. But if they do, be sure to select a device that is specified to allow the high voltage required by ICSP.

For additional information refer to Tech Brief TB087.

A Typical PICmicro® Microcontroller System with ICSP™ and an External Voltage Supervisor



Note 1: Some PICmicro® microcontrollers have a weak pull-up on the $\overline{MCLR}$ pin, so an external pull-up would not be required.

Product Specifications

Device	Reset Output A		Reset Output B		Voltage Trip Points (V) (min/max)		Reset Delay (ms) (min/max)		WDT Input	WDT Period (ms) (min/max)		MR Input	IDD (µA) (Typ/Max)	Packages
	Type	Active Level	Type	Active Level	Std.	Other Available(1)	Std.	Other Available(1)		Std.	Other Available(1)			
MCP1320	Open-Drain	Low	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	Yes	1/2(3)	5SOT-23
MCP1321	Open-Drain	Low	Push-Pull	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	–	1/2(3)	5SOT-23
MCP1322	Open-Drain	Low	Push-Pull	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	–	–	–	Yes	1/2(3)	5SOT-23
MCP111	Open-Drain	Low	–	–	1.85/1.95, 2.26/2.4, 2.56/2.7, 2.82/2.98, 2.85/3.0, 3.0/3.16, 4.27/4.5, 4.51/4.75	–	–	–	–	–	–		<1/1.75(2)	3SOT-23 3SC-70 3T0-92
MCP121	Open-Drain	Low	–	–	1.85/1.95, 2.26/2.4, 2.56/2.7, 2.85/3.0, 3.0/3.16, 4.27/4.5, 4.51/4.75	–	180	–	–	–	–		<1/1.75(2)	3SOT-23 3SC-70 3T0-92

1. Please contact Microchip sales for additional information. Minimum order quantities required.
2: Power-up Timer Active current is 20 mA. This is not the typical state.
3: Reset Delay Timer and Watchdog Timer Active current is 10 mA. This is not the typical state.

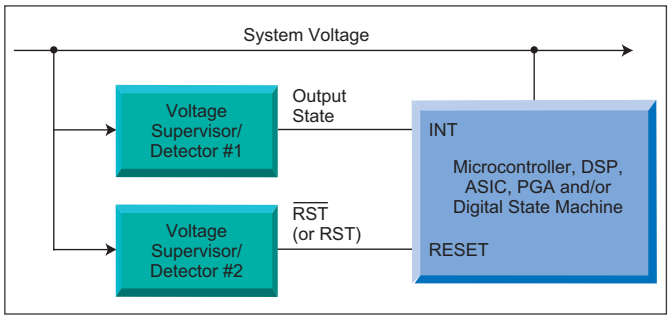
Voltage Windowing Using Voltage Supervisors

In some applications it is useful for the system controller (Microcontroller, DSP, ...) to get a "Heads Up" that the system voltage is approaching the hard reset level. This means that two voltage supervisors/detectors should be in the system, where one of the two has a trip point – a selected trip voltage higher than the other. This delta voltage ensures that the system has time to save the required information (in non-volatile memory) and prepare for being in reset. Microchip offers many devices that can be custom ordered specifying voltage trip points (and time-out). This allows the system designer to optimize the system to his requirements.

Systems could use this as a signal to save the data that they have in RAM to non-volatile memory (EEPROM/Flash memory) and continue to operate. But while in this "state", all reads and writes are addressed to these non-volatile memory locations. The system performance may be degraded due to the Read/Write latency of this memory, but the system is able to operate until the system voltage crosses the Reset Voltage trip point.

The figure below shows an example system with the two voltage detector/supervisors. Voltage Detector #1 indicates to the microcontroller when the system should save it's "data" to the non-volatile memory. While the "Output State" signal is active, the microcontroller would only read and write from this memory. Once the system voltage falls below the trip point of Voltage Supervisor #2, the microcontroller is forced into the reset state. This protects the system from the microcontroller operating outside of it's operating range (and causing unexpected system operation).

Voltage Windowing Block Diagram



Product Specifications

Device	Reset Output A			Reset Output B			Voltage Trip Points (V) (min/max)		Reset Delay (ms) (min/max)		WDT Input	WDT Period (ms) (min/max)		MR Input	IDD (µA) (Typ/ Max)	VDD Range (V)	Packages
	Type	Pull-up Resistor	Active Level	Type	Pull-up Resistor	Active Level	Std.	Other Available(1)	Std.	Other Available(1)		Std.	Other Available(1)				
MCP1316	Push-Pull	–	Low	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	1.0-5.5	3SOT-23 3SC-70 3TO-92
MCP1316M	Open-Drain	Internal	Low	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	1.0-5.5	3SOT-23 3SC-70
MCP1317	Push-PulIn	–	High	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	1.0-5.5	3SOT-23 3SC-70 3TO-92
MCP1318	Push-Pull	–	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	–	1/10	1.0-5.5	3SOT-23 3SC-70 3TO-92
MCP1318M	Open-Drain	Internal	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	–	1/10	1.0-5.5	3SOT-23 3SC-70 3TO-92
MCP1319	Push-Pull	–	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	–	–	–	Yes	1/10	1.0-5.5	3SOT-23 3SC-70 3TO-92
MCP1319M	Open-Drain	Internal	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	–	–	–	Yes	1/10	1.0-5.5	5SOT-23
MCP1320	Open-Drain	External	Low	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	1.0-5.5	5SOT-23
MCP1321	Open-Drain	External	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	–	1/10	1.0-5.5	5SOT-23
MCP1322	Open-Drain	External	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40, 1120/2240	–	–	–	Yes	1/10	1.0-5.5	5SOT-23

1. Please contact Microchip sales for additional information. Minimum order quantities required.

Voltage Windowing Using Voltage Supervisors (Continued)

Product Specifications

Device	Reset Output A			Reset Output B			Voltage Trip Points (V) (min/max)		Reset Delay (ms) (min/max)		WDT Input	WDT Period (ms) (min/max)		MR Input	IDD (µA) (Typ/ Max)	VDD Range (V)	Packages
	Type	Pull-up Resistor	Active Level	Type	Pull-up Resistor	Active Level	Std.	Other Available(1)	Std.	Other Available(1)		Std.	Other Available(1)				
TC51	Open-Drain	External	Low	–	–	–	2.16/2.24, 2.65/2.75, 2.94/3.06	1.6 to 6.0 (every 100 mV)	50/200	–	–	–	–	–	2.0/4.2	0.7-10.0	3SOT-23
TC52	Open-Drain	External	Low	Open-Drain	External	Low	2.94/3.06 (2.65/2.75), 4.41/4.59 (2.65/2.75)	1.6 to 5.0 (every 100 mV)	–	–	–	–	–	–	3.0/6.3	1.5-10.0	5SOT-23
TC53C	Push-Pull	–	Low	–	–	–	2.16/2.24, 2.65/2.75, 2.84/2.96	1.6 to 6.0 (every 100 mV)	–	–	–	–	–	–	2.0/4.2	1.5-10.0	5SOT-23
TC53N	Open-Drain	External	Low	–	–	–	2.16/2.24, 2.65/2.75, 2.84/2.96	1.6 to 6.0 (every 100 mV)	–	–	–	–	–	–	2.0/4.2	1.5-10.0	5SOT-23
TC54VC	Push-Pull	–	Low	–	–	–	1.37/1.43, 2.06/2.14, 2.65/2.75, 2.84/2.96, 2.94/3.06, 4.12/4.28, 4.21/4.39, 7.55/7.85	1.4 to 7.7 (every 100 mV)	–	–	–	–	–	–	1.1/3.6	0.7-10.0	3SOT-23 5SOT-23 4SOT-89 3T0-92
TC54VN	Open-Drain	External	Low	–	–	–	1.37/1.43, 2.06/2.14, 2.65/2.75, 2.84/2.96, 2.94/3.06, 4.12/4.28, 4.21/4.39, 7.55/7.85	1.4 to 7.7 (every 100 mV)	–	–	–	–	–	–	1.1/3.6	0.7-10.0	3SOT-23 5SOT-23 4SOT-89 3T0-92

1. Please contact Microchip sales for additional information. Minimum order quantities required.

Demo/Evaluation Support

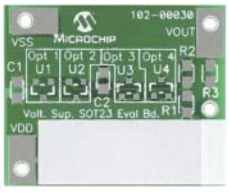
Microchip Technology offers several blank Printed Circuit Boards (PCBs). This allows customers to populate the device and supporting circuit to best evaluate the performance and characteristics of the desired device.

The following boards are available from the Microchip web site.

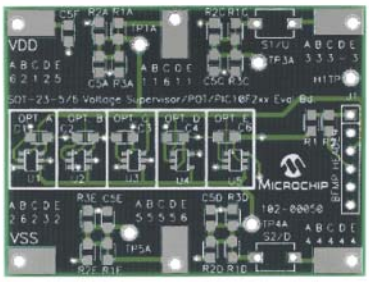
Blank Printed Circuit Boards

Name	Part Number	Package Types	# Pins	User's Guide Order Number
SOT-23-3 Evaluation Board	VSUPEV	SOT-23	3	DS51510
SOT-23-5/6 Evaluation Board	VSUPEV2	SOT-23	5 and 6	DS51527
8-Pin SOIC/MSOP/TSSOP/ IP Evaluation Board	SOIC8EV	DIP, MSOP, SOIC, TSSOP	8	DS51544

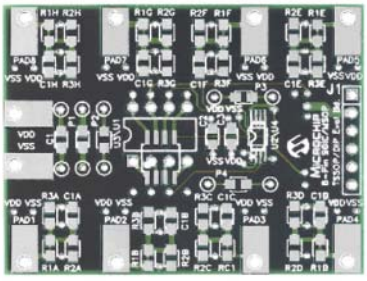
SOT-23-3 Voltage Supervisor Evaluation Board



SOT-23-5/6 Voltage Supervisor Evaluation Board



8-pin SOIC/MSOP/TSSOP/DIP Evaluation Board



RELATED SUPPORT MATERIAL

The following Application Notes and Technical Briefs are available on the Microchip web site: **www.microchip.com**

Application Notes

AN686: *Understanding and Using Supervisory Circuits*

This application note discusses what microcontroller supervisory devices are, why they are needed and some factors to consider when choosing one. Supervisory devices is a broad term that encompasses POR (power on reset) devices, BOD (brown-out detect) devices and watchdog timer devices. This application note will cover supervisor devices with POR and BOD functions only.

AN779: *Using the Microchip TC54 Voltage Detector*

This application note discusses the details of MOSFET driver power dissipation in relation to MOSFET gate charge and operating frequency. It also demonstrates how to match MOSFET driver current drive capability and MOSFET gate charge based on desired turn-on and turn-off times of the MOSFET. Microchip offers many variations of MOSFET drivers in various packages, which allows the designer to select the optimal MOSFET driver for the MOSFET(s) being used in their application.

AN805: *Upgrading the ON Semiconductor MC33x64/34x64 Reset IC*

ON Semiconductor's MC33x64 and MC34x64 series are some of the most commonly used processor supervisors for embedded controller designs. This application note discusses Microchip's TC54 series which provides the designer with a smaller, more efficient upgrade.

Technical Briefs

TB087: *Using Voltage Supervisors with PICmicro® Microcontroller Systems which Implement In-Circuit Serial Programming*

This technical brief will show how the MCP111 and MCP121 may be used in PICmicro microcontroller systems where ICSP™ is required.

User's Guides

Voltage Supervisor SOT-23 Evaluation Board User's Guide (DS51510)

Voltage Supervisor SOT-23-5/6 Evaluation Board User's Guide (DS51527)

8-Pin SOIC/MSOP/TSSOP/DIP Evaluation Board User's Guide (DS51544)

Analog and Interface Products

Thermal Management
- Temperature Sensors
- Fan Speed Controllers/ Fan Fault Detectors

Power Management
- LDO & Switching Regulators
- Charge Pump DC/DC Converters
- Power MOSFET Drivers
- PWM Controllers
- System Supervisors
- Voltage Detectors
- Voltage References

Battery Management
- Li-Ion/Li-Polymer Battery Chargers
- Smart Battery Managers

Linear
- Op Amps
- Programmable Gain Amplifiers
- Comparators
- Linear Integrated Devices

Mixed-Signal
- A/D Converter Families
- Digital Potentiometers
- D/A Converters
- V/F and F/V Converters
- Energy Measurement ICs

Interface
- CAN Peripherals
- Infrared Peripherals
- LIN Transceiver
- Serial Peripherals
- Ethernet Controller

Product Specifications

Device	Reset Output A[3]			Reset Output B[3]			Voltage Trip Points (V) (min/max)		Reset Delay (ms) (min/max)		WDT Input	WDT Period (ms) (min/max)		MR Input	IDD (µA) (Typ/Max)	VDD Range (V)	Temp. Range (°C)	Packages
	Type	Pull-up Resistor	Active Level	Type	Pull-up Resistor	Active Level	Std.	Other Available[1]	Std.	Other Available[1]		Std.	Other Available[1]					
MCP100	Push-Pull	–	Low	–	–	–	2.55/2.7, 2.85/3.0, 3.0/3.15, 4.25/4.5, 4.35/4.6, 4.5/4.75, 4.6/4.85	–	–	–	–	–	–	–	45/60	1.0-5.5		
MCP101	Push-Pull	–	High	–	–	–	2.55/2.7, 2.85/3.0, 3.0/3.15, 4.25/4.5, 4.35/4.6, 4.5/4.75, 4.6/4.85	–	–	–	–	–	–	–	45/60	1.0-5.5		
MCP102	Push-Pull	–	Low	–	–	–	1.85/1.95, 2.26/2.4, 2.56/2.7, 2.85/3.0, 3.0/3.16, 4.27/4.5, 4.51/4.75	–	180	–	–	–	–	–	<1/1.75[3]	1.0-5.5	-40 to +125	3SOT-23 3SC-70 3TO-92
MCP103	Push-Pull	–	Low	–	–	–	1.85/1.95, 2.26/2.4, 2.56/2.7, 2.85/3.0, 3.0/3.16, 4.27/4.5, 4.51/4.75	–	180	–	–	–	–	–	<1/1.75[3]	1.0-5.5	-40 to +125	3SOT-23 3SC-70
MCP111	Open-Drain	External	Low	–	–	–	1.85/1.95, 2.26/2.4, 2.56/2.7, 2.82/2.98, 2.85/3.0, 3.0/3.16, 4.27/4.5, 4.51/4.75	–	–	–	–	–	–	–	<1/1.75	1.0-5.5	-40 to +125	3SOT-23 3SC-70 3TO-92
MCP112	Push-Pull	–	Low	–	–	–	1.85/1.95, 2.26/2.4, 2.56/2.7, 2.82/2.98, 2.85/3.0, 3.0/3.16, 4.27/4.5, 4.51/4.75	–	–	–	–	–	–	–	<1/1.75	1.0-5.5	-40 to +125	3SOT-23 3SC-70 3TO-92
MCP120	Open-Drain	External	Low	–	–	–	2.55/2.7, 2.85/3.0, 3.0/3.15, 4.25/4.5, 4.35/4.6, 4.5/4.75, 4.6/4.85	–	–	–	–	–	–	–	45/60	1.0-5.5		
MCP121	Open-Drain	External	Low	–	–	–	1.85/1.95, 2.26/2.4, 2.56/2.7, 2.85/3.0, 3.0/3.16, 4.27/4.5, 4.51/4.75	–	180	–	–	–	–	–	<1/1.75[3]	1.0-5.5	-40 to +125	3SOT-23 3SC-70 3TO-92
MCP130	Open-Drain	Internal	Low	–	–	–	2.55/2.7, 2.85/3.0, 3.0/3.15, 4.25/4.5, 4.35/4.6, 4.5/4.75, 4.6/4.85	–	–	–	–	–	–	–	45/60	1.0-5.5		
MCP131	Open-Drain	Internal	Low	–	–	–	1.85/1.95, 2.26/2.4, 2.56/2.7, 2.85/3.0, 3.0/3.16, 4.27/4.5, 4.51/4.75	–	180	–	–	–	–	–	<1/1.75[3,4]	1.0-5.5	-40 to +125	3SOT-23 3SC-70 3TO-92
MCP1316	Push-Pull	–	Low	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	1.0-5.5	-40 to +125	5SOT-23
MCP1316M	Open-Drain	Internal	Low	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	1.0-5.5	-40 to +125	5SOT-23

1. Please contact Microchip sales for additional information. Minimum order quantities required.
2. Please contact Microchip sales for availability. Also see the device data sheet for final device specifications
3. There is additional current when the Reset Delay timer is active. This is not the typical state.
4. There is additional current when the RST pin is driving low, due to the internal pull-up resistor.

Product Specifications

Device	Reset Output A[3]			Reset Output B[3]			Voltage Trip Points (V) (min/max)		Reset Delay (ms) (min/max)		WDT Input	WDT Period (ms) (min/max)		MR Input	IDD (µA) (Typ/Max)	VDD Range (V)	Temp. Range (°C)	Packages
	Type	Pull-up Resistor	Active Level	Type	Pull-up Resistor	Active Level	Std.	Other Available[1]	Std.	Other Available[1]		Std.	Other Available[1]					
MCP1317	Push-Pull	–	High	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	1.0-5.5	-40 to +125	5SOT-23
MCP1318	Push-Pull	–	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	–	1/10	1.0-5.5	-40 to +125	5SOT-23
MCP1318M	Open-Drain	Internal	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	–	1/10	1.0-5.5	-40 to +125	5SOT-23
MCP1319	Push-Pull	–	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	–	–	–	Yes	1/10	1.0-5.5	-40 to +125	5SOT-23
MCP1319M	Open-Drain	Internal	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	–	–	–	Yes	1/10	1.0-5.5	-40 to +125	5SOT-23
MCP1320	Open-Drain	External	Low	–	–	–	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	Yes	1/10	1.0-5.5	-40 to +125	5SOT-23
MCP1321	Open-Drain	External	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	Yes	1120/2240	4.3/9.3, 71/153, 17900/38400	–	1/10	1.0-5.5	-40 to +125	5SOT-23
MCP1322	Open-Drain	External	Low	Push-Pull	–	High	2.83/2.97, 4.49/4.72	2.0 to 4.7 (every 100 mV)	140/280	1.0/2.0, 20/40 1120/2240	–	–	–	Yes	1/10	1.0-5.5	-40 to +125	5SOT-23
MCP809	Push-Pull	–	Low	–	–	–	2.55/2.7, 2.85/3.0, 3.0/3.15, 4.25/4.5, 4.35/4.6, 4.5/4.75, 4.6/4.85	–	150/700	–	–	–	–	–	45/60	1.0-5.5	-40 to +85	3SOT-23
MCP810	Push-Pull	–	High	–	–	–	2.55/2.7, 2.85/3.0, 3.0/3.15, 4.25/4.5, 4.35/4.6, 4.5/4.75, 4.6/4.85	–	150/700	–	–	–	–	–	45/60	1.0-5.5	-40 to +85	3SOT-23
TC1232	Open-Drain	External	Low	–	–	–	4.25/4.5, 4.5/4.75	–	250/ 1000	–	Yes	62.5/250, 250/1000, 500/2000	–	Yes	50/200	4.5-5.5	-40 to +85	8SOIC 8PDIP 16SOIC
TC1270	Push-Pull	–	Low	–	–	–	4.5/4.75, 4.25/4.5, 3.0/3.15, 2.85/3.0, 2.55/2.7, 1.7/1.8	–	140/560	–	–	–	–	Yes	7/15	1.2-5.5	-40 to +85	4SOT-143
TC1271	Push-Pull	–	High	–	–	–	4.5/4.75, 4.25/4.5, 3.0/3.15, 2.85/3.0, 2.55/2.7, 1.7/1.8	–	140/560	–	–	–	–	Yes	7/15	1.2-5.5	-40 to +85	4SOT-143

1. Please contact Microchip sales for additional information. Minimum order quantities required.
2. Please contact Microchip sales for availability. Also see the device data sheet for final device specifications
3. There is additional current when the Reset Delay timer is active. This is not the typical state.
4. There is additional current when the RST pin is driving low, due to the internal pull-up resistor.

Product Specifications

Device	Reset Output A			Reset Output B			Voltage Trip Points (V) (min/max)		Reset Delay (ms) (min/max)		WDT Input	WDT Period (ms) (min/max)		MR Input	IDD (µA) (Typ/Max)	VDD Range (V)	Temp. Range (°C)	Packages
	Type	Pull-up Resistor	Active Level	Type	Pull-up Resistor	Active Level	Std.	Other Available(1)	Std.	Other Available(1)		Std.	Other Available(1)					
TC1272	Push-Pull	–	Low	–	–	–	4.5/4.75, 4.25/4.5, 4.0/4.25	–	100/300	–	–	–	–	–	17/40	1.2-5.5	-40 to +85	3SOT-23
TC1272A	Push-Pull	–	Low	–	–	–	4.5/4.75, 4.25/4.5, 3.89/4.10, 3.00/3.15, 2.85/3.00, 2.55/2.70, 2.25/2.38	–	140/560	–	–	–	–	–	12/30	1.2-5.5	-40 to +125	3SOT-23
TC1273	Open-Drain	External	Low	–	–	–	4.5/4.75, 4.25/4.5, 4.0/4.25	–	100/300	–	–	–	–	–	17/40	1.2-5.5	-40 to +85	3SOT-23
TC1274	Push-Pull	–	High	–	–	–	4.5/4.75, 4.25/4.5, 4.0/4.25	–	100/300	–	–	–	–	–	17/40	1.8-5.5	-40 to +85	3SOT-23
TC1275	Push-Pull	–	Low	–	–	–	2.98/3.15, 2.8/2.97, 2.47/2.64	–	100/300	–	–	–	–	–	20/35	1.2-5.5	-40 to +85	3SOT-23
TC1276	Open-Drain	External	Low	–	–	–	2.98/3.15, 2.8/2.97, 2.47/2.64	–	100/300	–	–	–	–	–	20/35	1.2-5.5	-40 to +85	3SOT-23
TC1277	Push-Pull	–	High	–	–	–	2.98/3.15, 2.8/2.97, 2.47/2.64	–	100/300	–	–	–	–	–	20/35	1.8-5.5	-40 to +85	3SOT-23
TC1278	Open-Drain	Internal	High	–	–	–	4.5/4.75, 4.25/4.5, 4.0/4.25	–	250/450	–	–	–	–	–	0.9/40	1.2-5.5	-40 to +85	3SOT-23
TC1279	Open-Drain	Internal	Low	–	–	–	4.5/4.75, 4.25/4.5, 4.0/4.25	–	250/450	–	–	–	–	–	0.9/40	1.2-5.5	-40 to +85	3SOT-23
TC32M	Open-Drain	External	Low	–	–	–	4.25/4.5	–	500/900	–	Yes	500/900	–	–	50/200	4.5-5.5	-40 to +85	3SOT-223 3TO-92
TC51	Open-Drain	External	Low	–	–	–	2.16/2.24, 2.65/2.75, 2.94/3.06	1.6 to 6.0 (every 100 mV)	50/200	–	–	–	–	–	2.0/4.2	0.7-10.0	-40 to +85	3SOT-23
TC52	Open-Drain	External	Low	Open-Drain	External	Low	2.94/3.06 (2.65/ 2.75), 4.41/4.59 (2.65/2.75)	1.6 to 5.0 (every 100 mV)	–	–	–	–	–	–	3.0/6.3	1.5-10.0	-40 to +85	5SOT-23
TC53C	Push-Pull	–	Low	–	–	–	2.16/2.24, 2.65/2.75, 2.84/2.96	1.6 to 6.0 (every 100 mV)	–	–	–	–	–	–	2.0/4.2	1.5-10.0	-40 to +85	5SOT-23
TC53N	Open-Drain	External	Low	–	–	–	2.16/2.24, 2.65/2.75, 2.84/2.96	1.6 to 6.0 (every 100 mV)	–	–	–	–	–	–	2.0/4.2	0.7-10.0	-40 to +85	5SOT-23
TC54VC	Push-Pull	–	Low	–	–	–	1.37/1.43, 2.06/2.14, 2.65/2.75, 2.84/2.96, 2.94/3.06, 4.12/4.28, 4.21/4.39, 7.55/7.85	1.4 to 7.7 (every 100 mV)	–	–	–	–	–	–	1.1/3.6	0.7-10.0	-40 to +85	3SOT-23 5SOT-23 3SOT-89 3TO-92
TC54VN	Open-Drain	External	Low	–	–	–	1.37/1.43, 2.06/2.14, 2.65/2.75, 2.84/2.96, 2.94/3.06, 4.12/4.28, 4.21/4.39, 7.55/7.85	1.4 to 7.7 (every 100 mV)	–	–	–	–	–	–	1.1/3.6	0.7-10.0	-40 to +85	3SOT-23 5SOT-23 3SOT-89 3TO-92

1. Please contact Microchip sales for additional information. Minimum order quantities required.
2. Please contact Microchip sales for availability. Also see the device data sheet for final device specifications
3. There is additional current when the Reset Delay timer is active. This is not the typical state.
4. There is additional current when the RST pin is driving low, due to the internal pull-up resistor.

Product Specifications

Device	Reset Output A			Reset Output B			Voltage Trip Points (V) (min/max)		Reset Delay (ms) (min/max)		WDT Input	WDT Period (ms) (min/max)		MR Input	IDD (µA) (Typ/Max)	VDD Range (V)	Temp. Range (°C)	Packages
	Type	Pull-up Resistor	Active Level	Type	Pull-up Resistor	Active Level	Std.	Other Available(1)	Std.	Other Available(1)		Std.	Other Available(1)					
TCM809	Push-Pull	–	Low	–	–	–	4.5/4.75, 4.25/4.5, 3.89/4.1, 3.0/3.15, 2.85/3.0, 2.55/2.7, 2.25/2.38	–	140/560	–	–	–	–	–	12/30	1.2-5.5	-40 to +125	3SOT-23 3SC-70
TCM810	Push-Pull	–	High	–	–	–	4.5/4.75, 4.25/4.5, 3.89/4.1, 3.0/3.15, 2.85/3.0, 2.55/2.7, 2.25/2.38	–	140/560		–	–		–	12/30	1.2-5.5	-40 to +125	3SOT-23 3SC-70
TCM811	Push-Pull	–	Low	–	–	–	4.5/4.75, 4.25/4.5, 3.0/3.15, 2.85/3.0, 2.55/2.7, 1.7/1.8	–	140/560		–	–		Yes	6/15	1.0-5.5	-40 to +85	4SOT-143
TCM812	Push-Pull	–	High	–	–	–	4.5/4.75, 4.25/4.5, 3.0/3.15, 2.85/3.0, 2.55/2.7, 1.7/1.8	–	140/560		–	–		Yes	6/15	1.1-5.5	-40 to +85	4SOT-143

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4. There is additional current when the RST pin is driving low, due to the internal pull-up resistor.

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