

## Microcontroller Supervisory Circuit with Open Drain Output

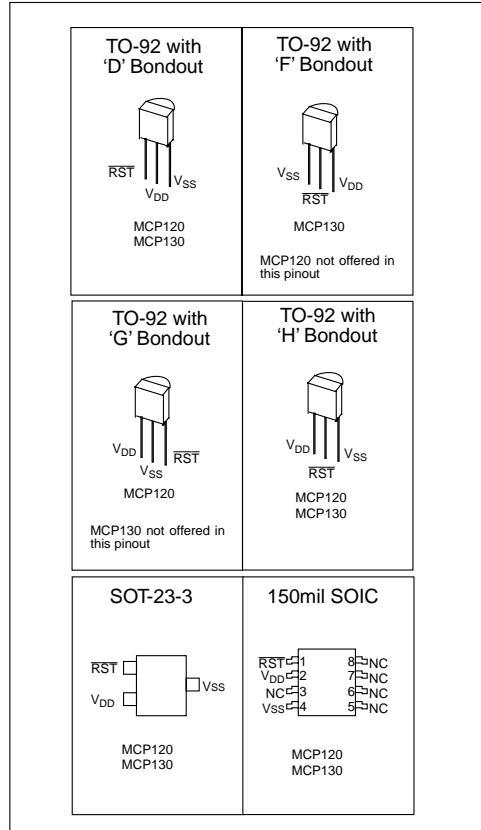
### FEATURES

- Holds microcontroller in reset until supply voltage reaches stable operating level
- Resets microcontroller during power loss
- Precision monitoring of 3V, 3.3V, and 5V systems
- 7 voltage trip points available
- Active low RESET pin
- Open drain output
- Internal pullup resistor (5K $\Omega$ ) for MCP130
- Holds RESET for 350 ms (typical)
- Guaranteed RESET to  $V_{CC} = 1.0V$
- Accuracy of  $\pm 125mV$  for 5V systems and  $\pm 75mV$  for 3V systems over temperature
- 45  $\mu A$  typical operating current
- Temperature range:
  - Industrial (I): -40°C to +85°C

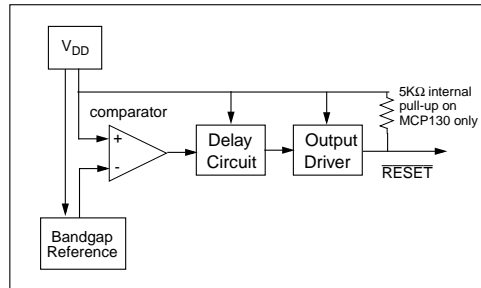
### DESCRIPTION

The Microchip Technology Inc. MCP120/130 is a voltage supervisory device designed to keep a microcontroller in reset until the system voltage has reached the proper level and stabilized. It also operates as protection from brown-out conditions when the supply voltage drops below a safe operating level. Both devices are available with a choice of seven different trip voltages and both have open drain outputs. The MCP130 has an internal 5K $\Omega$  pullup resistor. Both devices have active low RESET pins. The MCP120/130 will assert the RESET signal whenever the voltage on the  $V_{DD}$  pin is below the trip-point voltage.

### PACKAGES



### BLOCK DIAGRAM



## 1.0 ELECTRICAL CHARACTERISTICS

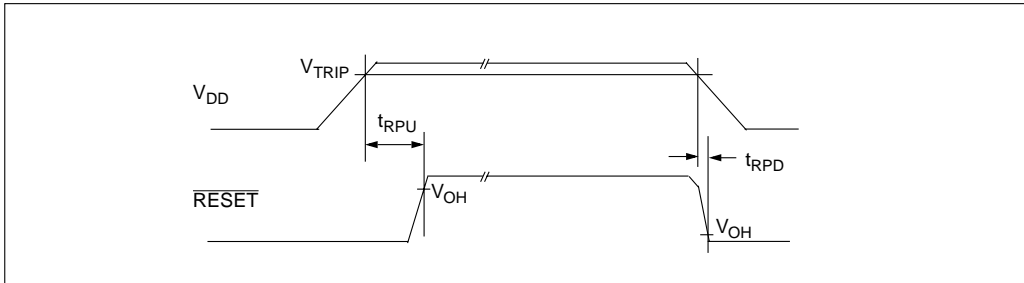
### 1.1 Maximum Ratings\*

$V_{DD}$ .....	7.0V
All inputs and outputs w.r.t. $V_{SS}$ .....	-0.6V to $V_{DD} + 1.0V$
Storage temperature .....	-65°C to +150°C
Ambient temp. with power applied .....	-65°C to +125°C
Soldering temperature of leads (10 seconds) .....	+300°C
ESD protection on all pins .....	$\geq 2$ kV

**\*Notice:** Stresses above those listed under "Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

## DC AND AC CHARACTERISTICS

All parameters apply at the specified temp and voltage ranges unless otherwise noted.		$V_{DD} = 1.0 - 5.5V$ Industrial (I): -40°C to +85°C					
PARAMETER		SYMBOL	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Operating Voltage Range		$V_{DD}$	1.0		5.5	V	
$V_{DD}$ Value to Guarantee $\overline{RESET}$		$V_{DDMIN}$	1.0			V	
Operating Current		$I_{DD}$		45	60	$\mu A$	$V_{DD} = 5.5V$ (no load)
$V_{DD}$ Trip Point	MCP1X0-270	$V_{TRIP}$	2.55	2.625	2.7	V	
	MCP1X0-300		2.85	2.925	3.0		
	MCP1X0-315		3.0	3.075	3.15		
	MCP1X0-450		4.25	4.375	4.50		
	MCP1X0-460		4.35	4.475	4.60		
	MCP1X0-475		4.50	4.625	4.75		
	MCP1X0-485		4.60	4.725	4.85		
$\overline{RESET}$ Low Level Output Voltage	MCP1X0-270 MCP1X0-300 MCP1X0-315	$V_{OL}$			0.4	V	$I_{OL} = 3.2mA,$ $V_{DD} = V_{TRIPMIN}$
	MCP1X0-450 MCP1X0-460 MCP1X0-475 MCP1X0-485				0.6		
$\overline{RESET}$ High Level Output Voltage (MCP130 Only)	MCP130-XXX (All $V_{TRIP}$ Points)	$V_{OH}$	$V_{DD}-0.7$			V	$I_{OH} = 50\mu A, V_{DD} > V_{TRIPMAX}$
Pullup Resistor (MCP130 Only)				5		$k\Omega$	
Output Leakage (MCP120 Only)				1		$\mu A$	
Threshold Hysteresis		$V_{HYS}$		50		mV	
$V_{DD}$ Detect to $\overline{RESET}$ Inactive		$t_{RPU}$	150	350	700	ms	
$V_{DD}$ Detect to $\overline{RESET}$		$t_{RPD}$		10		$\mu s$	$V_{DD}$ ramped from $V_{TRIPMAX} + 250mV$ down to $V_{TRIPMIN} - 250mV$
<b>Note:</b> Typical values are for 25°C and $V_{DD} = 5.0V$							

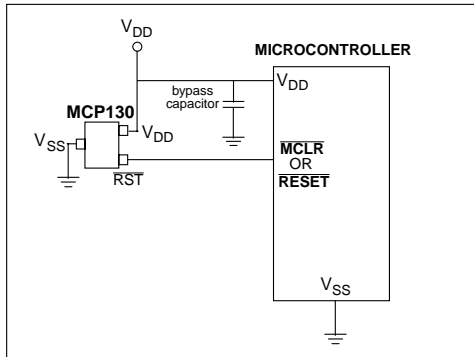


**FIGURE 1:** MCP120/130 Timing Diagram

## 2.0 APPLICATIONS INFORMATION

### 2.1 The Need for Supervisory Circuits

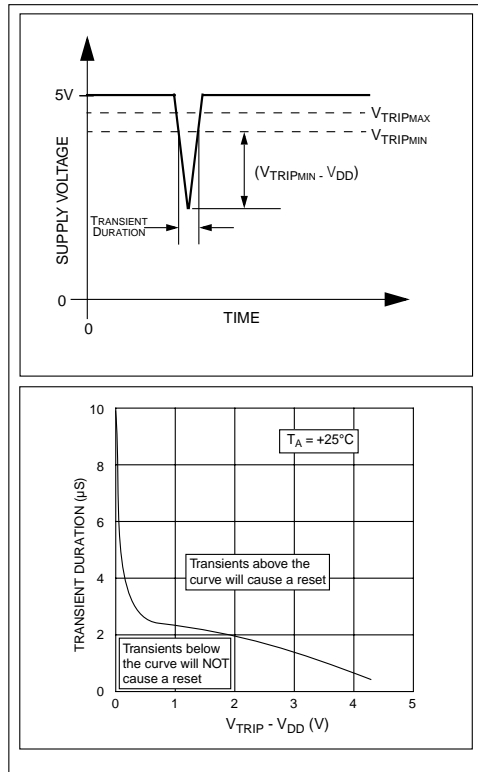
For many of today's microcontroller applications, care must be taken to prevent low power conditions that can cause many different system problems. The most common causes are brown-out conditions where the system supply drops below the operating level momentarily, and the second, is when a slowly decaying power supply causes the microcontroller to begin executing instructions without enough voltage to sustain SRAM and producing indeterminate results.



**FIGURE 2-1:** Typical Application

### 2.2 Negative Going $V_{DD}$ Transients

Many system designers implementing POR circuits are concerned about the minimum pulse width required to cause a reset. Figure 2-2 shows typical transient voltage below the trip point ( $V_{TRIP} - V_{DD}$ ) vs. transient duration. It shows that the farther below the trip point the transient pulse goes, the duration of the pulse required to cause a reset gets shorter. A 0.1  $\mu F$  bypass cap mounted as close as possible to the  $V_{DD}$  pin provides additional transient immunity.



**FIGURE 2-2:** Typical Transient Response

## 2.3 Effect of Temperature on Timeout Period ( $t_{RPU}$ )

The timeout period ( $t_{RPU}$ ) determines how long the device remains in the reset condition. This is controlled by an internal RC timer and is effected by both  $V_{DD}$  and temperature. The graph shown in Figure 2-3 shows typical response for different  $V_{DD}$  values and temperatures.

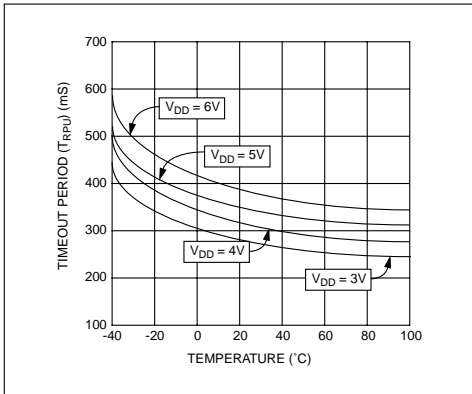


FIGURE 2-3:  $t_{RPU}$  vs. Temperature

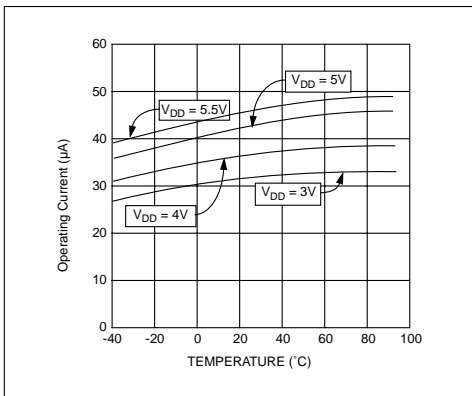


FIGURE 2-4:  $I_{DD}$  vs. Temperature

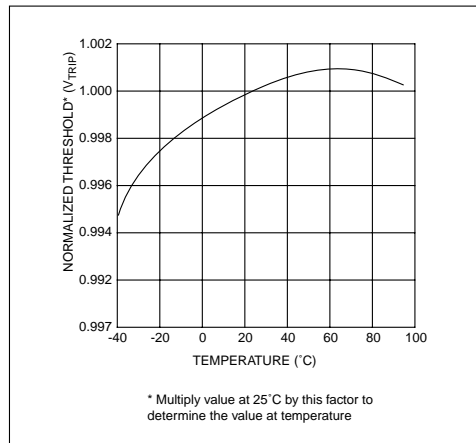


FIGURE 2-5: Normalized  $V_{TRIP}$  vs. Temperature

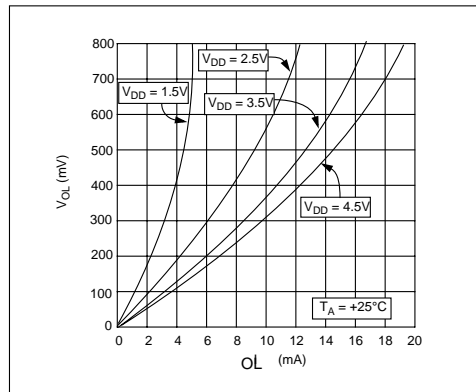


FIGURE 2-6:  $V_{OL}$  vs.  $I_{OL}$

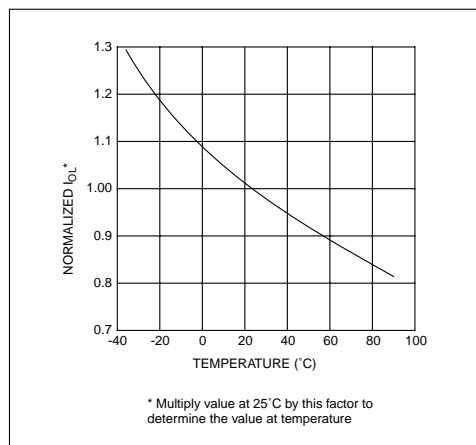


FIGURE 2-7: Normalized  $I_{OL}$  vs. Temperature

## MCP120/130 PRODUCT IDENTIFICATION SYSTEM

<p><b>MCP120/130</b> — <b>xxx b I /pp</b></p> <p><b>Package</b></p> <p><b>Temperature Range</b></p> <p><b>Bondout Option (TO-92 only)</b></p> <p><b>RESET V<sub>TRIP</sub> Voltage</b></p> <p><b>Device</b></p>	<p>TO = TO-92 (3-lead) [offered in bags only]            TT = SOT-23 (3-lead) [offered in tape &amp; reel only]            SN = SOIC (8-lead, 150 mil Body)</p> <p>I = -40°C to +85°C (only offered in I)</p> <p>D = D Bond Option (see bond option diagrams)            F = F Bond Option            G = G Bond Option            H = H Bond Option</p> <p>270 = <math>2.55 \leq V_{TRIP} \leq 2.70</math>            300 = <math>2.85 \leq V_{TRIP} \leq 3.00</math>            315 = <math>3.00 \leq V_{TRIP} \leq 3.15</math>            450 = <math>4.25 \leq V_{TRIP} \leq 4.50</math>            460 = <math>4.35 \leq V_{TRIP} \leq 4.60</math>            475 = <math>4.50 \leq V_{TRIP} \leq 4.75</math>            485 = <math>4.60 \leq V_{TRIP} \leq 4.85</math></p> <p>MCP120 = Supervisor circuit with open drain output.            MCP120T = Supervisor circuit with open drain output (tape &amp; reel).            MCP130 = Supervisor circuit with open drain output and internal pullup resistor.            MCP130T = Supervisor circuit with open drain output and internal pullup resistor (tape &amp; reel).</p>
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**Product Identification Options for MCP120/130**

TO-92 with 'D' Bondout	TO-92 with 'F' Bondout	TO-92 with 'G' Bondout	TO-92 with 'H' Bondout	SOT-23-3	150mil SOIC
MCP120-XXXD I/TO MCP130-XXXD I/TO	MCP130-XXXF I/TO MCP120 not offered in this pinout	MCP120-XXXG I/TO MCP130 not offered in this pinout	MCP120-XXXH I/TO MCP130-XXXH I/TO	MCP120-XXX I/TT MCP130-XXX I/TT	MCP120-XXX I/SN MCP130-XXX I/SN

**Example of Product Identification:**

For the MCP130 (open drain output with internal pull up resistor) with V<sub>TRIP</sub> range of 2.55V - 2.70V in TO-92 package with 'F' bond option in industrial temp range, the part number would be: MCP130-270F I/TO.

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Products supported by a preliminary Data Sheet may have an errata sheet describing minor operational differences and recommended workarounds. To determine if an errata sheet exists for a particular device, please contact one of the following:

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# MCP120/130

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**NOTES:**



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