MCP120/130

Microcontroller Supervisory Circuit with Open Drain Output

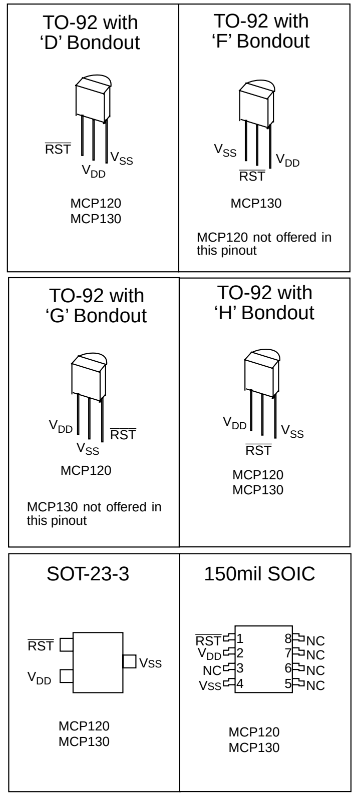
FEATURES

- 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 $\overline{\text{RESET}}$ pin
- Open drain output
- Internal pullup resistor (5KΩ) for MCP130
- Holds $\overline{\text{RESET}}$ for 350 ms (typical)
- Guaranteed $\overline{\text{RESET}}$ to V_{CC} = 1.0V
- Accuracy of ±125mV for 5V systems and ±75mV for 3V systems over temperature
- 45 µA typical operating current
- Temperature range:
  - Industrial (I): -40°C to +85°C

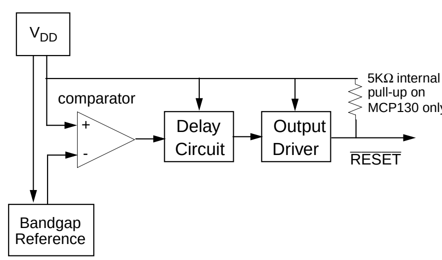
DESCRIPTION

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 5KΩ pullup resistor. Both devices have active low $\overline{\text{RESET}}$ pins. The MCP120/130 will assert the $\overline{\text{RESET}}$ 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 .... ≥ 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	µA	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		I_{OL} = 8.5mA, V_{DD} = $V_{TRIPMIN}$
$\overline{RESET}$ High Level Output Voltage (MCP130 Only)	MCP130-XXX (All V_{TRIP} Points)	V_{OH}	V_{DD}-0.7			V	I_{OH} = 50µA,V_{DD} > $V_{TRIPMAX}$
Pullup Resistor (MCP130 Only)				5		kΩ	
Output Leakage (MCP120 Only)				1		µA	
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		µs	V_{DD} ramped from $V_{TRIPMAX}$ + 250mV down to $V_{TRIPMIN}$ - 250mV

Note: Typical values are for 25˚C and V_{DD} = 5.0V

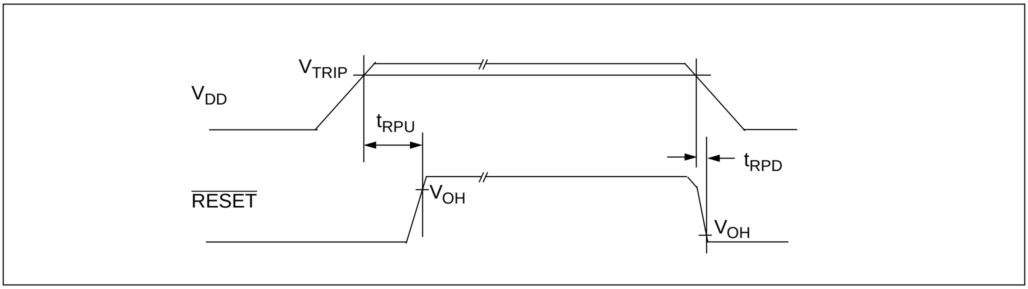


FIGURE 1: MCP120/130 Timing Diagram

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.

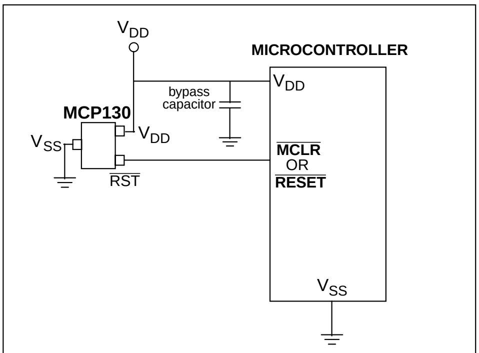


FIGURE 2-1: Typical Application

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 µF bypass cap mounted as close as possible to the V_{DD} pin provides additional transient immunity.

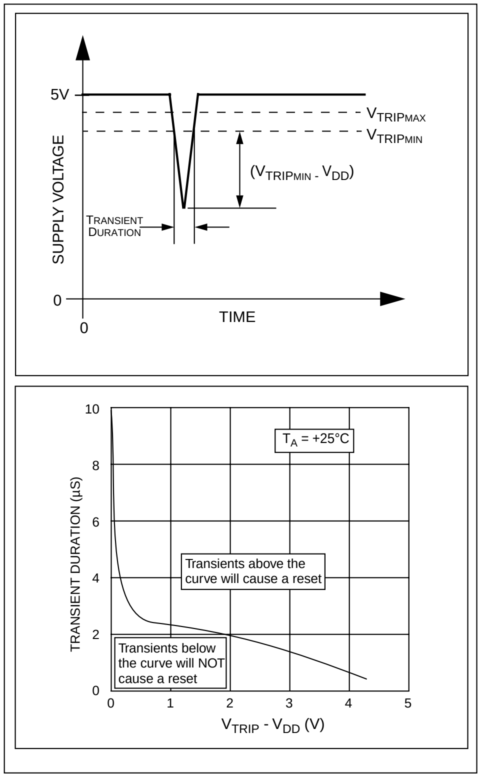


FIGURE 2-2: Typical Transient Response

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.

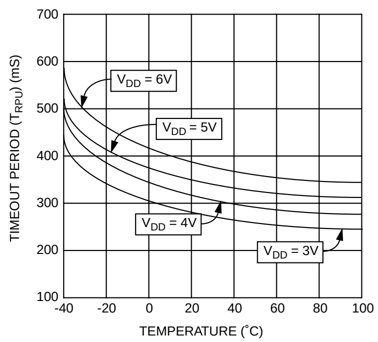


FIGURE 2-3: *t_{RPU} vs. Temperature*

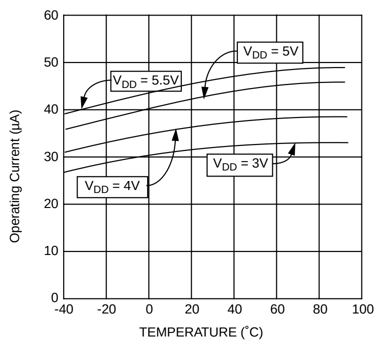


FIGURE 2-4: *IDD vs. Temperature*

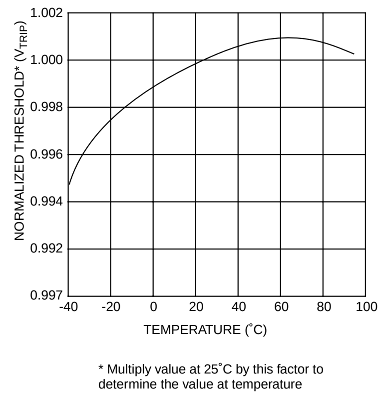


FIGURE 2-5: *Normalized V_{TRIP} vs. Temperature*

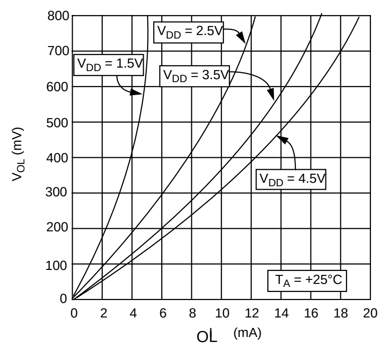


FIGURE 2-6: *V_{OL} vs. I_{OL}*

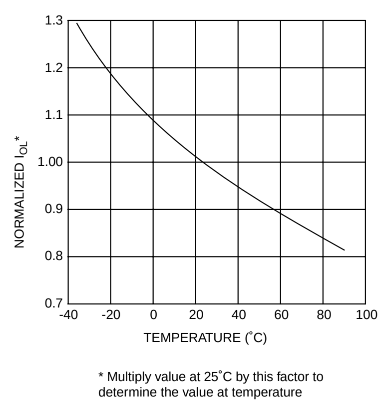


FIGURE 2-7: *Normalized I_{OL} vs. Temperature*

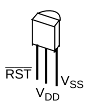
MCP120/130 PRODUCT IDENTIFICATION SYSTEM

MCP120/130 — xxx b I /pp

Package	TO	=	TO-92 (3-lead) [offered in bags only]
	TT	=	SOT-23 (3-lead) [offered in tape & reel only]
	SN	=	SOIC (8-lead, 150 mil Body)
Temperature Range	I	=	–40˚C to +85˚C (only offered in I)
Bondout Option (TO-92 only)	D	=	D Bond Option (see bond option diagrams)
	F	=	F Bond Option
	G	=	G Bond Option
	H	=	H Bond Option
$\overline{\text{RESET}}$ V_{TRIP} Voltage	270	=	$2.55 \le V_{TRIP} \le 2.70$
	300	=	$2.85 \le V_{TRIP} \le 3.00$
	315	=	$3.00 \le V_{TRIP} \le 3.15$
	450	=	$4.25 \le V_{TRIP} \le 4.50$
	460	=	$4.35 \le V_{TRIP} \le 4.60$
	475	=	$4.50 \le V_{TRIP} \le 4.75$
	485	=	$4.60 \le V_{TRIP} \le 4.85$
Device	MCP120	=	Supervisor circuit with open drain output.
	MCP120T	=	Supervisor circuit with open drain output (tape & reel).
	MCP130	=	Supervisor circuit with open drain output and internal pullup resistor.
	MCP130T	=	Supervisor circuit with open drain output and internal pullup resistor (tape & reel).

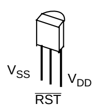
Product Identification Options for MCP120/130

TO-92 with 'D' Bondout



MCP120-XXXD I/TO
MCP130-XXXD I/TO

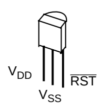
TO-92 with 'F' Bondout



MCP130-XXXF I/TO

MCP120 not offered in this pinout

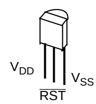
TO-92 with 'G' Bondout



MCP120-XXXG I/TO

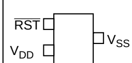
MCP130 not offered in this pinout

TO-92 with 'H' Bondout



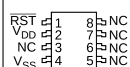
MCP120-XXXH I/TO
MCP130-XXXH I/TO

SOT-23-3



MCP120-XXX I/TT
MCP130-XXX I/TT

150mil SOIC



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_{TRIP} range of 2.55V - 2.70V in T0-92 package with 'F' bond option in industrial temp range, the part number would be: MCP130-270F I/TO.

Sales and Support

Data Sheets

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:

1. Your local Microchip sales office
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