

## 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 pull-up resistor (5 k $\Omega$ ) for MCP130
- Holds  $\overline{\text{RESET}}$  for 350 ms (typical)
- $\overline{\text{RESET}}$  to  $V_{CC} = 1.0V$
- Accuracy of  $\pm 125$  mV for 5V systems and  $\pm 75$  mV 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 5 k $\Omega$  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 VDD pin is below the trip-point voltage.

### PACKAGES



### BLOCK DIAGRAM



## 1.0 ELECTRICAL CHARACTERISTICS

### 1.1 Maximum Ratings\*

V<sub>DD</sub>.....7.0V  
 All inputs and outputs w.r.t. V<sub>SS</sub> .....-0.6V to V<sub>DD</sub> +1.0V  
 Storage temperature ..... -65°C to +150°C  
 Ambient temp. with power applied ..... -65°C to +125°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 <sub>DD</sub> = 1.0 - 5.5V Industrial (I): -40°C to +85°C					
Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions	
Operating Voltage Range	V <sub>DD</sub>	1.0	—	5.5	V		
V <sub>DD</sub> Value to RESET	V <sub>DD</sub> <sub>MIN</sub>	1.0	—	—	V		
Operating Current	I <sub>DD</sub>	—	45	60	μA	V <sub>DD</sub> = 5.5V (no load)	
V <sub>DD</sub> Trip Point	MCP1X0-270 MCP1X0-300 MCP1X0-315 MCP1X0-450 MCP1X0-460 MCP1X0-475 MCP1X0-485	V <sub>TRIP</sub>	2.55 2.85 3.0 4.25 4.35 4.50 4.60	2.625 2.925 3.075 4.375 4.475 4.625 4.725	2.7 3.0 3.15 4.50 4.60 4.75 4.85	V	
RESET Low Level Output Voltage	MCP1X0-270 MCP1X0-300 MCP1X0-315	V <sub>OL</sub>	—	—	0.4	V	I <sub>OL</sub> = 3.2 mA, V <sub>DD</sub> = V <sub>TRIP</sub> <sub>MIN</sub>
	MCP1X0-450 MCP1X0-460 MCP1X0-475 MCP1X0-485		—	—	0.6		I <sub>OL</sub> = 8.5 mA, V <sub>DD</sub> = V <sub>TRIP</sub> <sub>MIN</sub>
RESET High Level Output Voltage (MCP130 Only)	MCP130-xxx (All V <sub>TRIP</sub> Points)	V <sub>OH</sub>	V <sub>DD</sub> -0.7	—	—	V	I <sub>OH</sub> = 50 μA, V <sub>DD</sub> > V <sub>TRIP</sub> <sub>MAX</sub>
Pull-up Resistor (MCP130 Only)			—	5	—	kΩ	
Output Leakage (MCP120 Only)			—	1	—	μA	
Threshold Hysteresis	V <sub>HYS</sub>	—	50	—	—	mV	
V <sub>DD</sub> Detect to RESET Inactive	t <sub>RPU</sub>	150	350	700	—	ms	
V <sub>DD</sub> Detect to RESET	t <sub>RPD</sub>	—	10	—	—	μs	V <sub>DD</sub> ramped from V <sub>TRIP</sub> <sub>MAX</sub> + 250 mV down to V <sub>TRIP</sub> <sub>MIN</sub> - 250 mV
<b>Note:</b> Typical values are for 25°C and V <sub>DD</sub> = 5.0V							



Figure 1-1: MCP120/130 Timing Diagram

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## 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<sub>DD</sub> 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  $\mu\text{F}$  bypass cap mounted as close as possible to the V<sub>DD</sub> pin provides additional transient immunity.



Figure 2-2: Typical Transient Response

## 2.3 Effect of Temperature on Timeout Period (trPU)

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

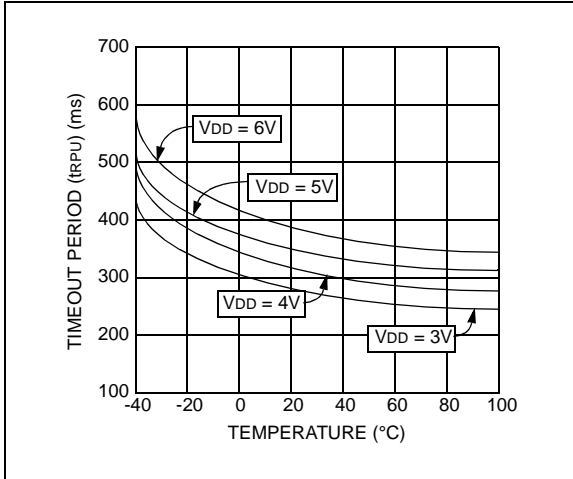


Figure 2-3: trPU vs. Temperature

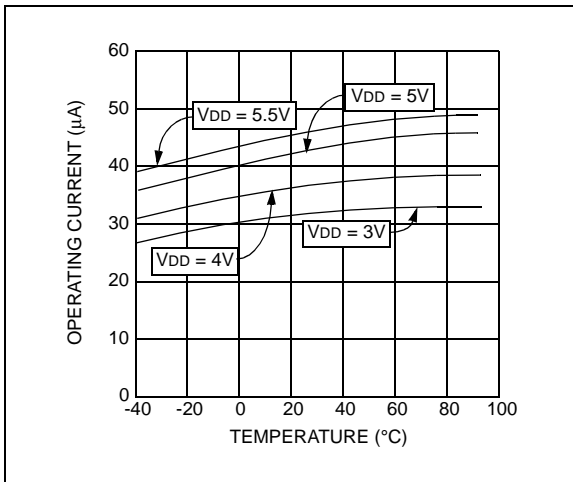


Figure 2-4: IDD vs. Temperature



Figure 2-5: Normalized VTRIP vs. Temperature



Figure 2-6: VOL vs. IOL



Figure 2-7: Normalized IOL vs. Temperature

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## 3.0 PACKAGING INFORMATION

### 3.1 Package Marking Information

3-Lead Plastic Transistor Outline (TO-92)



Example:



8-Lead Plastic Small Outline (SOIC)



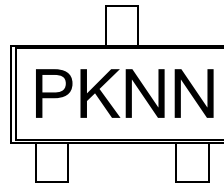
Example:



3-Lead Plastic Small Outline Transistor (SOT23)



Example:



#### SOT23 PARTS LABELING:

The table below identifies the first 2 characters (XX) in the 4-character field (XXNN) for marking of the 3-Lead SOT23 package.

Mark	Part Number	Mark	Part Number
SJ	MCP120T-270I/TT	PJ	MCP130T-270I/TT
SK	MCP120T-300I/TT	PK	MCP130T-300I/TT
SL	MCP120T-315I/TT	PL	MCP130T-315I/TT
SM	MCP120T-450I/TT	PM	MCP130T-450I/TT
SN	MCP120T-460I/TT	PN	MCP130T-460I/TT
SO	MCP120T-475I/TT	PO	MCP130T-475I/TT
SP	MCP120T-485I/TT	PP	MCP130T-485I/TT

<b>Legend:</b>	XX...X	Customer specific information*
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
<b>Note:</b>	In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line thus limiting the number of available characters for customer specific information.	

\* Standard OTP marking consists of Microchip part number, year code, week code, and traceability code. For OTP marking beyond this, certain price adders apply. Please check with your Microchip Sales Office. For QTP devices, any special marking adders are included in QTP price.

## 3.2 Package Detail Information

### 3-Lead Plastic Transistor Outline (TO) (TO-92)



Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		3			3	
Pitch	p		.050			1.27	
Bottom to Package Flat	A	.130	.143	.155	3.30	3.62	3.94
Overall Width	E1	.175	.186	.195	4.45	4.71	4.95
Overall Length	D	.170	.183	.195	4.32	4.64	4.95
Molded Package Radius	R	.085	.090	.095	2.16	2.29	2.41
Tip to Seating Plane	L	.500	.555	.610	12.70	14.10	15.49
Lead Thickness	c	.014	.017	.020	0.36	0.43	0.51
Lead Width	B	.016	.019	.022	0.41	0.48	0.56
Mold Draft Angle Top	$\alpha$	4	5	6	4	5	6
Mold Draft Angle Bottom	$\beta$	2	3	4	2	3	4

\*Controlling Parameter

**Notes:**

Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.  
 JEDEC Equivalent: TO-92  
 Drawing No. C04-101

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## 3-Lead Plastic Small Outline Transistor (TT) (SOT23)



Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		3			3	
Pitch	p		.038			0.96	
Outside lead pitch (basic)	p1		.076			1.92	
Overall Height	A	.035	.040	.044	0.89	1.01	1.12
Molded Package Thickness	A2	.035	.037	.040	0.88	0.95	1.02
Standoff §	A1	.000	.002	.004	0.01	0.06	0.10
Overall Width	E	.083	.093	.104	2.10	2.37	2.64
Molded Package Width	E1	.047	.051	.055	1.20	1.30	1.40
Overall Length	D	.110	.115	.120	2.80	2.92	3.04
Foot Length	L	.014	.018	.022	0.35	0.45	0.55
Foot Angle	φ	0	5	10	0	5	10
Lead Thickness	c	.004	.006	.007	0.09	0.14	0.18
Lead Width	B	.015	.017	.020	0.37	0.44	0.51
Mold Draft Angle Top	α	0	5	10	0	5	10
Mold Draft Angle Bottom	β	0	5	10	0	5	10

\* Controlling Parameter  
 § Significant Characteristic

**Notes:**  
 Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.  
 JEDEC Equivalent: TO-236  
 Drawing No. C04-104



## 8-Lead Plastic Small Outline (SN) – Narrow, 150 mil (SOIC)



Units		INCHES*			MILLIMETERS		
Dimension	Limits	MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		8			8	
Pitch	p		.050			1.27	
Overall Height	A	.053	.061	.069	1.35	1.55	1.75
Molded Package Thickness	A2	.052	.056	.061	1.32	1.42	1.55
Standoff §	A1	.004	.007	.010	0.10	0.18	0.25
Overall Width	E	.228	.237	.244	5.79	6.02	6.20
Molded Package Width	E1	.146	.154	.157	3.71	3.91	3.99
Overall Length	D	.189	.193	.197	4.80	4.90	5.00
Chamfer Distance	h	.010	.015	.020	0.25	0.38	0.51
Foot Length	L	.019	.025	.030	0.48	0.62	0.76
Foot Angle	φ	0	4	8	0	4	8
Lead Thickness	c	.008	.009	.010	0.20	0.23	0.25
Lead Width	B	.013	.017	.020	0.33	0.42	0.51
Mold Draft Angle Top	α	0	12	15	0	12	15
Mold Draft Angle Bottom	β	0	12	15	0	12	15

\* Controlling Parameter  
 § Significant Characteristic

**Notes:**

Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.  
 JEDEC Equivalent: MS-012  
 Drawing No. C04-057

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Literature Number: **DS11184D**

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# MCP120/130

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NOTES:

NOTES:

# MCP120/130

## PRODUCT IDENTIFICATION SYSTEM

To order or to obtain information (e.g., on pricing or delivery), please refer to the factory or the listed sales offices.

<u>PART NO.</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>XX</u>
Device	<u>RESET/RESET VTRIP Voltage</u>	<u>Bondout Option</u>	<u>Temperature Range</u>	<u>Package</u>
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 pull-up resistor		
	MCP130T:	Supervisor circuit with open drain output and internal pull-up resistor (tape & reel)		
<u>RESET/RESET VTRIP Voltage</u>	270 =	2.55 ≤ VTRIP ≤ 2.70		
	300 =	2.85 ≤ VTRIP ≤ 3.00		
	315 =	3.00 ≤ VTRIP ≤ 3.15		
	450 =	4.25 ≤ VTRIP ≤ 4.50		
	460 =	4.35 ≤ VTRIP ≤ 4.60		
	475 =	4.50 ≤ VTRIP ≤ 4.75		
	485 =	4.60 ≤ VTRIP ≤ 4.85		
<u>Bondout Option: (TO-92 Only)</u>	D =	D Bond Option (see bond option chart)		
	F =	F Bond Option		
	G =	G Bond Option		
	H =	H Bond Option		
<u>Temperature Range:</u>	I =	-40°C to +85°C (only offered in I)		
<u>Package:</u>	SN =	SOIC (8-lead, 150 mil body)		
	TO =	TO-92 (3-lead) [offered in bags only]		
	TT =	SOT-23 (3-lead) [offered in tape & reel only]		

**Examples:**

- MCP120-270I/SN = VTRIP range of 2.55V - 2.70V, Industrial Temp., SOIC package
- MCP120-300DI/TO = VTRIP range of 2.85V - 3.00V, Bonding Option D, Industrial Temp., TO-92 package
- MCP120T-315I/TT = VTRIP range of 3.00V - 3.15V, Industrial Temp., SOT-23 package
- MCP130-450I/SN = VTRIP range of 4.25V - 4.50V, Industrial Temp., SOIC package
- MCP130-460FI/TO = VTRIP range of 4.35V - 4.60V, Bonding Option F, Industrial Temp., TO-92 package
- MCP130T-475I/TT = Tape & Reel, VTRIP range of 4.50V - 4.75V, Industrial Temp., SOT-23 package

TO-92 with 'D' Bondout



MCP120  
MCP130

TO-92 with 'F' Bondout



MCP130

TO-92 with 'G' Bondout



MCP120

TO-92 with 'H' Bondout



MCP120  
MCP130

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#### New York

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Hauppauge, NY 11788  
Tel: 631-273-5305 Fax: 631-273-5335

#### San Jose

Microchip Technology Inc.  
2107 North First Street, Suite 590  
San Jose, CA 95131  
Tel: 408-436-7950 Fax: 408-436-7955

#### Toronto

6285 Northam Drive, Suite 108  
Mississauga, Ontario L4V 1X5, Canada  
Tel: 905-673-0699 Fax: 905-673-6509

### ASIA/PACIFIC

#### Australia

Microchip Technology Australia Pty Ltd  
Suite 22, 41 Rawson Street  
Epping 2121, NSW  
Australia  
Tel: 61-2-9868-6733 Fax: 61-2-9868-6755

#### China - Beijing

Microchip Technology Beijing Office  
Unit 915  
New China Hong Kong Manhattan Bldg.  
No. 6 Chaoyangmen Beidajie  
Beijing, 100027, No. China  
Tel: 86-10-85282100 Fax: 86-10-85282104

#### China - Shanghai

Microchip Technology Shanghai Office  
Room 701, Bldg. B  
Far East International Plaza  
No. 317 Xian Xia Road  
Shanghai, 200051  
Tel: 86-21-6275-5700 Fax: 86-21-6275-5060

#### Hong Kong

Microchip Asia Pacific  
RM 2101, Tower 2, Metroplaza  
223 Hing Fong Road  
Kwai Fong, N.T., Hong Kong  
Tel: 852-2401-1200 Fax: 852-2401-3431

#### India

Microchip Technology Inc.  
India Liaison Office  
Divyasree Chambers  
1 Floor, Wing A (A3/A4)  
No. 11, O'Shaughnessey Road  
Bangalore, 560 025, India  
Tel: 91-80-2290061 Fax: 91-80-2290062

#### Japan

Microchip Technology Intl. Inc.  
Benex S-1 6F  
3-18-20, Shinyokohama  
Kohoku-Ku, Yokohama-shi  
Kanagawa, 222-0033, Japan  
Tel: 81-45-471-6166 Fax: 81-45-471-6122

### ASIA/PACIFIC (continued)

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#### Singapore

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Singapore, 188980  
Tel: 65-334-8870 Fax: 65-334-8850

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Microchip Technology Taiwan  
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Tung Hua North Road  
Taipei, 105, Taiwan  
Tel: 886-2-2717-7175 Fax: 886-2-2545-0139

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Regus Business Centre  
Lautrup høj 1-3  
Ballerup DK-2750 Denmark  
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Gustav-Heinemann Ring 125  
D-81739 Munich, Germany  
Tel: 49-89-627-144 0 Fax: 49-89-627-144-44

#### Germany

Analog Product Sales  
Lochhamer Strasse 13  
D-82152 Martinsried, Germany  
Tel: 49-89-895650-0 Fax: 49-89-895650-22

#### Italy

Arizona Microchip Technology SRL  
Centro Direzionale Colleoni  
Palazzo Taurus 1 V. Le Colleoni 1  
20041 Agrate Brianza  
Milan, Italy  
Tel: 39-039-65791-1 Fax: 39-039-6899883

#### United Kingdom

Arizona Microchip Technology Ltd.  
505 Eskdale Road  
Winnersh Triangle  
Wokingham  
Berkshire, England RG41 5TU  
Tel: 44 118 921 5869 Fax: 44-118 921-5820

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#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.