

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 Ω) for MCP130
- Holds $\overline{\text{RESET}}$ for 350 ms (typical)
- $\overline{\text{RESET}}$ to $V_{CC} = 1.0V$
- Accuracy of ± 125 mV for 5V systems and ± 75 mV 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 5 k Ω 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_{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
 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 RESET | V _{DD} _{MIN} | 1.0 | — | — | V | | |
| Operating Current | I _{DD} | — | 45 | 60 | μA | V _{DD} = 5.5V (no load) | |
| V _{DD} Trip Point | MCP1X0-270 MCP1X0-300 MCP1X0-315 MCP1X0-450 MCP1X0-460 MCP1X0-475 MCP1X0-485 | V _{TRIP} | 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 _{OL} | — | — | 0.4 | V | I _{OL} = 3.2 mA, V _{DD} = V _{TRIP} _{MIN} |
| | MCP1X0-450 MCP1X0-460 MCP1X0-475 MCP1X0-485 | | — | — | 0.6 | | I _{OL} = 8.5 mA, V _{DD} = V _{TRIP} _{MIN} |
| RESET High Level Output Voltage (MCP130 Only) | MCP130-xxx (All V _{TRIP} Points) | V _{OH} | V _{DD} -0.7 | — | — | V | I _{OH} = 50 μA, V _{DD} > V _{TRIP} _{MAX} |
| Pull-up Resistor (MCP130 Only) | | | — | 5 | — | kΩ | |
| Output Leakage (MCP120 Only) | | | — | 1 | — | μA | |
| Threshold Hysteresis | V _{HYS} | — | 50 | — | — | mV | |
| V _{DD} Detect to RESET Inactive | t _{RPU} | 150 | 350 | 700 | — | ms | |
| V _{DD} Detect to RESET | t _{RPD} | — | 10 | — | — | μs | V _{DD} ramped from V _{TRIP} _{MAX} + 250 mV down to V _{TRIP} _{MIN} - 250 mV |
| Note: Typical values are for 25°C and V _{DD} = 5.0V | | | | | | | |

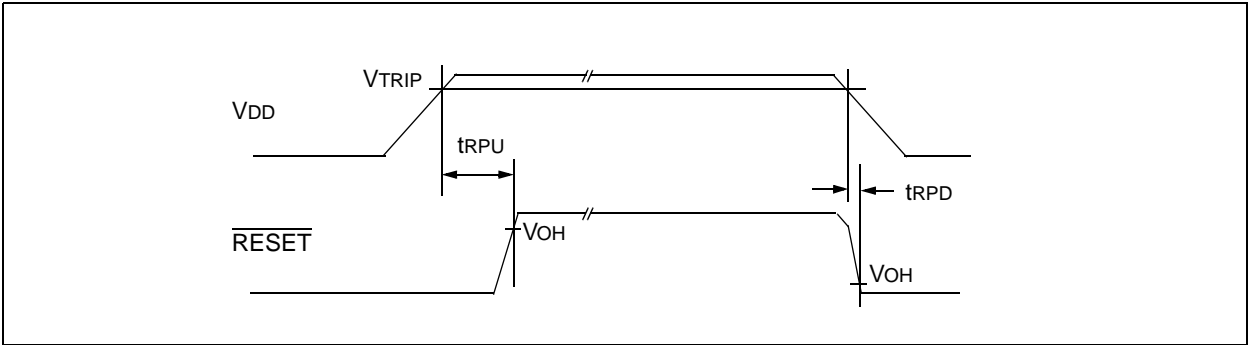


Figure 1-1: MCP120/130 Timing Diagram

MCP120/130

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 (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 |

| | | |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Legend: | 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 |
| Note: | 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 | α | 4 | 5 | 6 | 4 | 5 | 6 |
| Mold Draft Angle Bottom | β | 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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Device: **MCP120/130**

Literature Number: **DS11184D**

Questions:

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NOTES:

NOTES:

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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/</u> <u>RESET</u> <u>VTRIP</u> <u>Voltage</u> | <u>Bondout</u> <u>Option</u> | <u>Temperature</u> <u>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</u> <u>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:</u> (TO-92 Only) | 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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01/30/01

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