

Microcontroller Supervisory Circuit with Push-Pull 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 (MCP100) or active high RESET (MCP101)
- Push-pull output
- Holds $\overline{\text{RESET}}$ /RESET for 350 ms (typical)
- $\overline{\text{RESET}}$ /RESET to $V_{DD} = 1.0V$
- Accuracy of ± 125 mV for 5V systems and ± 75 mV for 3V systems over temperature
- 45 μA typical operating current
- Temperature range:
 - Industrial (I): $-40^{\circ}C$ to $+85^{\circ}C$

Description

The Microchip Technology Inc. MCP100/101 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 push-pull outputs. The MCP100 has a low active $\overline{\text{RESET}}$ pin and the MCP101 has a high active RESET pin. The MCP100/101 will assert the $\overline{\text{RESET}}$ /RESET signal whenever the voltage on the V_{DD} pin is below the trip-point voltage.

Packages

TO-92 with 'D' Bondout



TO-92 with 'H' Bondout



SOT-23-3



ILLUSTRATIONS NOT TO SCALE

Block Diagram



MCP100/101

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 $\overline{RESET}/RESET$ | | V_{DDMIN} | 1.0 | — | — | V | |
| Operating Current | | I_{DD} | — | 45 | 60 | μA | $V_{DD} = 5.5V$ (no load) |
| V_{DD} Trip Point | MCP10X-270 | V_{TRIP} | 2.55 | 2.625 | 2.7 | V | |
| | MCP10X-300 | | 2.85 | 2.925 | 3.0 | | |
| | MCP10X-315 | | 3.0 | 3.075 | 3.15 | | |
| | MCP10X-450 | | 4.25 | 4.375 | 4.50 | | |
| | MCP10X-460 | | 4.35 | 4.475 | 4.60 | | |
| | MCP10X-475 | | 4.50 | 4.625 | 4.75 | | |
| RESET Low Level Output Voltage (MCP100) | | V_{OL} | — | — | 0.4 | V | $I_{OL} = 3.2$ mA, $V_{DD} = V_{TRIPMIN}$ |
| MCP100-450 MCP100-460 MCP100-475 MCP100-485 | | | — | — | 0.6 | | |
| RESET High Level Output Voltage (MCP100) | | V_{OH} | $V_{DD}-0.7$ | — | — | V | $I_{OH} = 3$ mA, $V_{DD} > V_{TRIPMAX}$ |
| RESET Low Level Output Voltage (MCP101) | | V_{OL} | — | — | 0.4 | V | $I_{OL} = 3.2$ mA, $V_{DD} > V_{TRIPMAX}$ |
| MCP101-450 MCP101-460 MCP101-475 MCP101-485 | | | — | — | 0.6 | | |
| RESET High level Output Voltage (MCP101) | | V_{OH} | $V_{DD}-0.7$ | — | — | V | $I_{OH} = 3$ mA, $V_{DD} = V_{TRIPMIN}$ |
| Threshold Hysteresis | | V_{HYS} | — | 50 | — | mV | |
| V_{DD} Detect to $\overline{RESET}/RESET$ Inactive | | t_{RPU} | 150 | 350 | 700 | ms | |
| V_{DD} Detect to $\overline{RESET}/RESET$ | | t_{RPD} | — | 10 | — | μs | V_{DD} ramped from $V_{TRIPMAX} + 250$ mV down to $V_{TRIPMIN} - 250$ mV |



Figure 1-1: MCP100/101 Timing Diagram

MCP100/101

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.

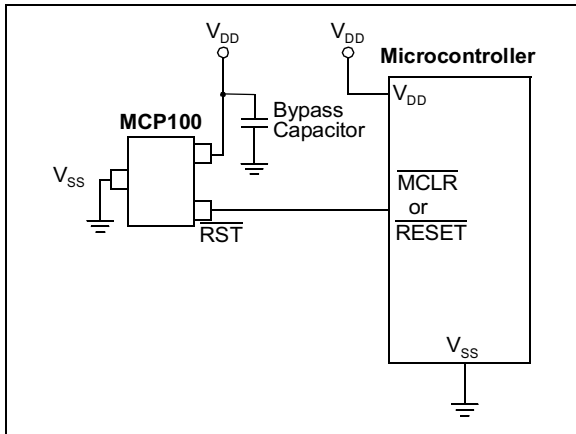


Figure 2-1: Typical Application

Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

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 duration vs. reset comparator overdrive for which the MCP100/101 will not generate a reset pulse. 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 (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: Typical 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}



MCP100/101

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

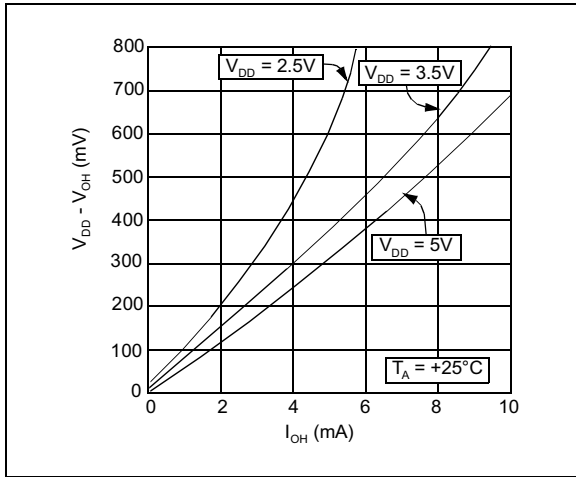


Figure 2-8: $V_{DD} - V_{OH}$ vs. I_{OH}

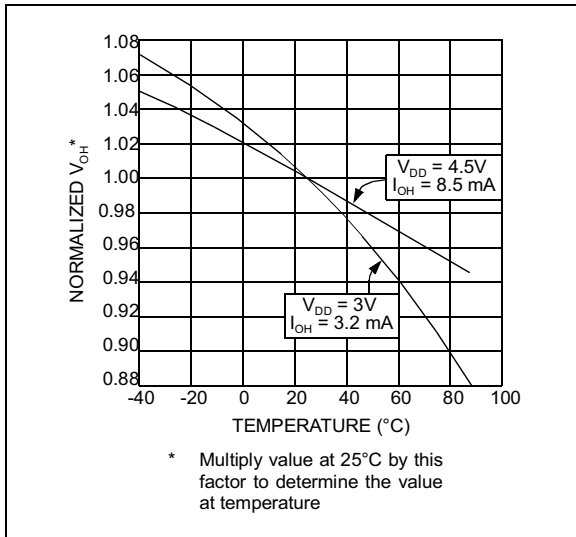


Figure 2-9: Normalized V_{OH} vs. Temperature

3.0 PACKAGING INFORMATION

3.1 Package Marking Information

ILLUSTRATIONS NOT TO SCALE

3-Lead Plastic Transistor Outline (TO-92)



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 |
|------|-----------------|------|-----------------|
| QJ | MCP100T-270I/TT | RJ | MCP101T-270I/TT |
| QK | MCP100T-300I/TT | RK | MCP101T-300I/TT |
| QL | MCP100T-315I/TT | RL | MCP101T-315I/TT |
| QM | MCP100T-450I/TT | RM | MCP101T-450I/TT |
| QN | MCP100T-460I/TT | RN | MCP101T-460I/TT |
| QO | MCP100T-475I/TT | RO | MCP101T-475I/TT |
| QP | MCP100T-485I/TT | RP | MCP101T-485I/TT |

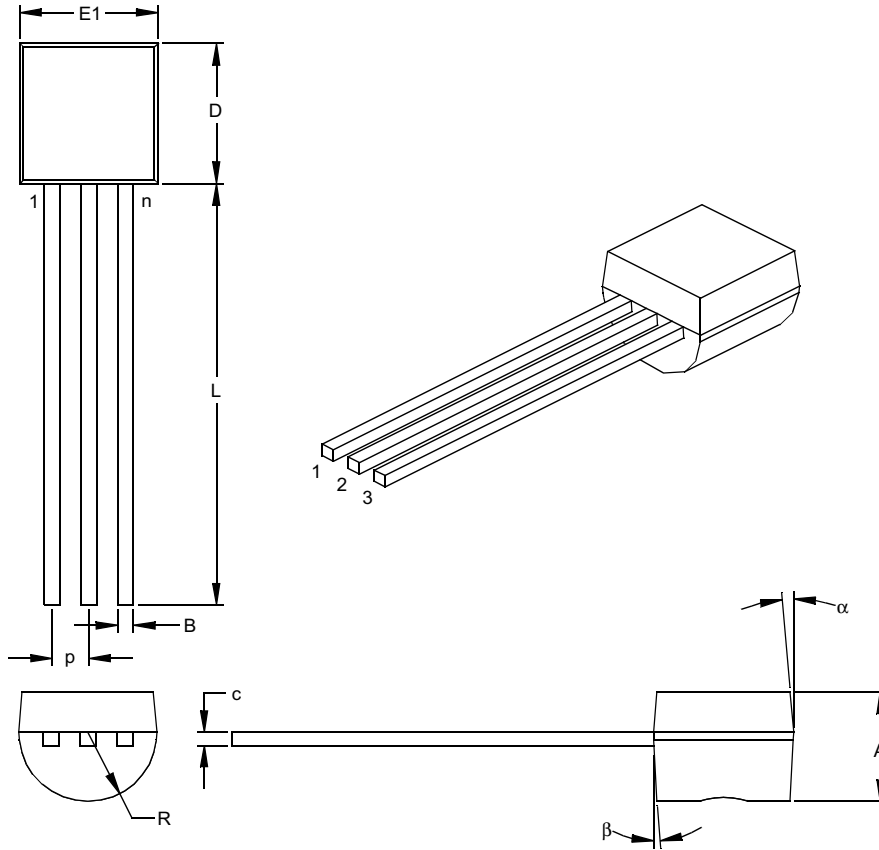
| | | |
|----------------|--|--|
| Legend: | XX...X | Customer specific information* |
| | YY | Year code (last 2 digits of calendar year) |
| | WW | Week code (week of January 1 is week '01') |
| | NNN | Alphanumeric traceability code |
| Note: | In the event the full Microchip part number cannot be 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.

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3.2 Package Detail Information

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



| Dimension Limits | Units | INCHES* | | | MILLIMETERS | | |
|-------------------------|----------|---------|------|------|-------------|-------|-------|
| | | 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

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

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To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

| <u>PART NO.</u> | <u>X</u> | <u>X</u> | <u>X</u> | <u>XX</u> |
|---|---|---|----------------------|-----------|
| Device | <u>RESET/</u> <u>RESET</u> <u>V_{TRIP}</u> Voltage | Bondout Option | Temperature Range | Package |
| Device: | MCP100: | Supervisor circuit with active low <u>RESET</u> output | | |
| | MCP100T: | Supervisor circuit with active low <u>RESET</u> output (tape & reel) | | |
| | MCP101: | Supervisor circuit with active high <u>RESET</u> output | | |
| | MCP101T: | Supervisor circuit with active high <u>RESET</u> output (tape & reel) | | |
| <u>RESET/RESET</u> V _{TRIP} Voltage: | 270 = | 2.55 ≤ V _{TRIP} ≤ 2.70 | | |
| | 300 = | 2.85 ≤ V _{TRIP} ≤ 3.00 | | |
| | 315 = | 3.00 ≤ V _{TRIP} ≤ 3.15 | | |
| | 450 = | 4.25 ≤ V _{TRIP} ≤ 4.50 | | |
| | 460 = | 4.35 ≤ V _{TRIP} ≤ 4.60 | | |
| | 475 = | 4.50 ≤ V _{TRIP} ≤ 4.75 | | |
| | 485 = | 4.60 ≤ V _{TRIP} ≤ 4.85 | | |
| Bondout Option: (TO-92 Only) | D = | D Bond Option (see bond option chart) | | |
| | H = | H Bond Option | | |
| Temperature Range: | I = | -40°C to +85°C (only offered in I) | | |
| Package: | TO = | TO-92 (3-lead) [offered in bags only] | | |
| | TT = | SOT-23 (3-lead) [offered in tape & reel only] | | |

Examples:

- MCP100-270DI/TO = V_{TRIP} range of 2.55V - 2.70V, Bonding Option D, Industrial Temp., TO-92 package
- MCP100T-450I/TT = V_{TRIP} range of 4.25V - 4.50V, Industrial Temp., SOT-23 package
- MCP101-270HI/TO = V_{TRIP} range of 2.55V - 2.70V, Bonding Option H, Industrial Temp., TO-92 package
- MCP101T-315I/TT = V_{TRIP} range of 3.00V - 3.15V, Industrial Temp., SOT-23 package

TO-92 with
'D' Bondout



RST or RST
V_{DD} V_{SS}

TO-92 with
'H' Bondout



V_{DD} V_{SS}
RST or RST

SOT-23-3



RST or RST
V_{DD} V_{SS}

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Tel: 937-291-1654 Fax: 937-291-9175

Detroit

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Tel: 248-538-2250 Fax: 248-538-2260

Los Angeles

18201 Von Karman, Suite 1090
Irvine, CA 92612
Tel: 949-263-1888 Fax: 949-263-1338

New York

150 Motor Parkway, Suite 202
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 Consulting (Shanghai)
Co., Ltd., Beijing Liaison Office
Unit 915
Bei Hai Wan Tai Bldg.
No. 6 Chaoyangmen Beidajie
Beijing, 100027, No. China
Tel: 86-10-85282100 Fax: 86-10-85282104

China - Chengdu

Microchip Technology Consulting (Shanghai)
Co., Ltd., Chengdu Liaison Office
Rm. 2401, 24th Floor,
Ming Xing Financial Tower
No. 88 TIDU Street
Chengdu 610016, China
Tel: 86-28-6766200 Fax: 86-28-6766599

China - Fuzhou

Microchip Technology Consulting (Shanghai)
Co., Ltd., Fuzhou Liaison Office
Rm. 531, North Building
Fujian Foreign Trade Center Hotel
73 Wusi Road
Fuzhou 350001, China
Tel: 86-591-7557563 Fax: 86-591-7557572

China - Shanghai

Microchip Technology Consulting (Shanghai)
Co., Ltd.
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

China - Shenzhen

Microchip Technology Consulting (Shanghai)
Co., Ltd., Shenzhen Liaison Office
Rm. 1315, 13/F, Shenzhen Kerry Centre,
Renminnan Lu
Shenzhen 518001, China
Tel: 86-755-2350361 Fax: 86-755-2366086

Hong Kong

Microchip Technology Hongkong Ltd.
Unit 901-6, 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 Japan K.K.
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

Korea

Microchip Technology Korea
168-1, Youngbo Bldg. 3 Floor
Samsung-Dong, Kangnam-Ku
Seoul, Korea 135-882
Tel: 82-2-554-7200 Fax: 82-2-558-5934

Singapore

Microchip Technology Singapore Pte Ltd.
200 Middle Road
#07-02 Prime Centre
Singapore, 188980
Tel: 65-334-8870 Fax: 65-334-8850

Taiwan

Microchip Technology Taiwan
11F-3, No. 207
Tung Hua North Road
Taipei, 105, Taiwan
Tel: 886-2-2717-7175 Fax: 886-2-2545-0139

EUROPE

Denmark

Microchip Technology Denmark ApS
Regus Business Centre
Lautrup høj 1-3
Ballerup DK-2750 Denmark
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Parc d'Activite du Moulin de Massy
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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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