

## Microcontroller Supervisory Circuit with Push-Pull Output

### Features

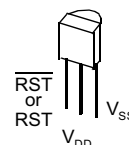
- Holds microcontroller in reset until supply voltage reaches stable operating level
- Resets microcontroller during power loss
- Precision monitoring of 3V, 3.3V and 5V systems
- 7 voltage trip points available
- Active low  $\overline{\text{RESET}}$  pin (MCP100) or active high RESET (MCP101)
- Push-pull output
- Holds  $\overline{\text{RESET}}$ /RESET for 350 ms (typical)
- $\overline{\text{RESET}}$ /RESET to  $V_{DD} = 1.0V$
- Accuracy of  $\pm 125$  mV for 5V systems and  $\pm 75$  mV for 3V systems over temperature
- 45  $\mu A$  typical operating current
- Temperature range:
  - Industrial (I):  $-40^{\circ}C$  to  $+85^{\circ}C$

### Description

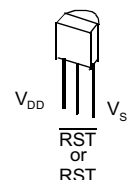
The Microchip Technology Inc. MCP100/101 is a voltage supervisory device designed to keep a microcontroller in reset until the system voltage has reached the proper level and stabilized. It also operates as protection from brown-out conditions when the supply voltage drops below a safe operating level. 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

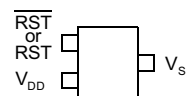
#### TO-92 with 'D' Bondout



#### TO-92 with 'H' Bondout

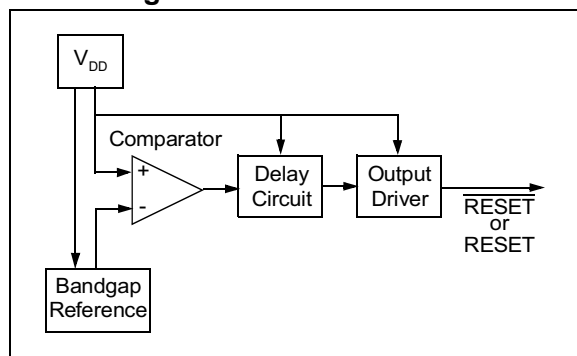


#### SOT-23-3



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 .....  $\geq 2$  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. |                                                                                                | $V_{DD} = 1.0 - 5.5V$<br>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                                                          | $\mu A$                                            | $V_{DD} = 5.5V$ (no load)                                                  |
| $V_{DD}$ Trip Point                                                                   | MCP10X-270<br>MCP10X-300<br>MCP10X-315<br>MCP10X-450<br>MCP10X-460<br>MCP10X-475<br>MCP10X-485 | $V_{TRIP}$                                              | 2.55<br>2.85<br>3.0<br>4.25<br>4.35<br>4.50<br>4.60 | 2.625<br>2.925<br>3.075<br>4.375<br>4.475<br>4.625<br>4.725 | 2.7<br>3.0<br>3.15<br>4.50<br>4.60<br>4.75<br>4.85 | V                                                                          |
| $\overline{RESET}$ Low Level Output Voltage (MCP100)                                  | MCP100-270<br>MCP100-300<br>MCP100-315                                                         | $V_{OL}$                                                | —                                                   | —                                                           | 0.4                                                | $I_{OL} = 3.2$ mA,<br>$V_{DD} = V_{TRIPMIN}$                               |
|                                                                                       | MCP100-450<br>MCP100-460<br>MCP100-475<br>MCP100-485                                           |                                                         | —                                                   | —                                                           | 0.6                                                | $I_{OL} = 8.5$ mA,<br>$V_{DD} = V_{TRIPMIN}$                               |
| $\overline{RESET}$ High Level Output Voltage (MCP100)                                 | MCP100-XXX<br>(All $V_{TRIP}$ Points)                                                          | $V_{OH}$                                                | $V_{DD}-0.7$                                        | —                                                           | —                                                  | V<br>$I_{OH} = 3$ mA,<br>$V_{DD} > V_{TRIPMAX}$                            |
| $\overline{RESET}$ Low Level Output Voltage (MCP101)                                  | MCP101-270<br>MCP101-300<br>MCP101-315                                                         | $V_{OL}$                                                | —                                                   | —                                                           | 0.4                                                | $I_{OL} = 3.2$ mA,<br>$V_{DD} > V_{TRIPMAX}$                               |
|                                                                                       | MCP101-450<br>MCP101-460<br>MCP101-475<br>MCP101-485                                           |                                                         | —                                                   | —                                                           | 0.6                                                | $I_{OL} = 8.5$ mA,<br>$V_{DD} > V_{TRIPMAX}$                               |
| $\overline{RESET}$ High level Output Voltage (MCP101)                                 | MCP101-XXX<br>(All $V_{TRIP}$ Points)                                                          | $V_{OH}$                                                | $V_{DD}-0.7$                                        | —                                                           | —                                                  | V<br>$I_{OH} = 3$ mA,<br>$V_{DD} = V_{TRIPMIN}$                            |
| 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                                                  | —                                                           | $\mu s$                                            | $V_{DD}$ ramped from $V_{TRIPMAX} + 250$ mV down to $V_{TRIPMIN} - 250$ mV |

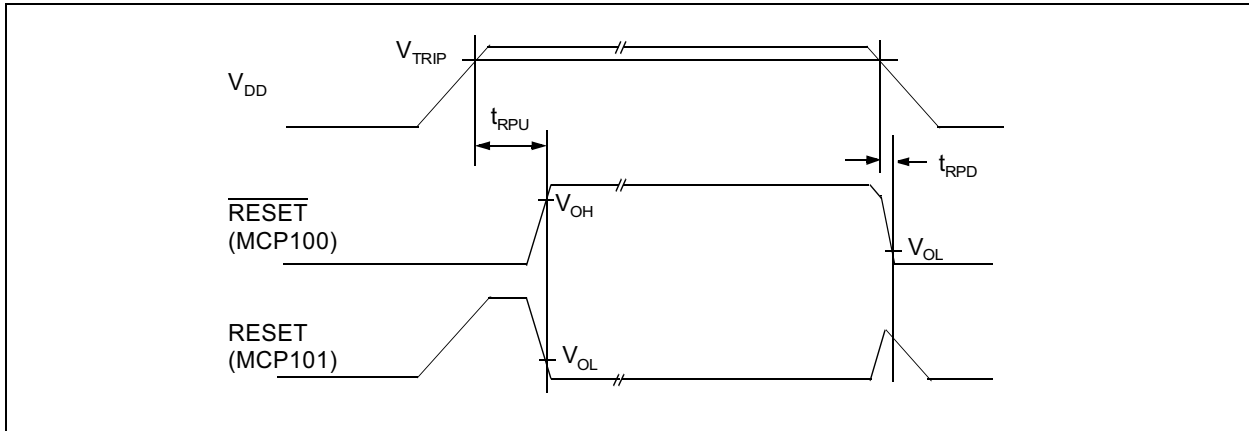


**Figure 1-1:** MCP100/101 Timing Diagram

# 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.

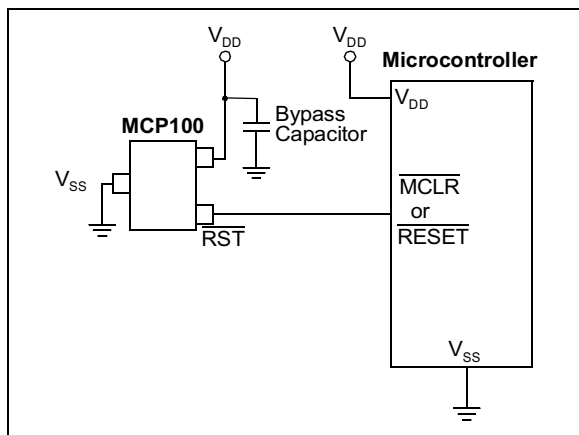


**Figure 2-1:** Typical Application

**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  $\mu\text{F}$  bypass cap mounted as close as possible to the  $V_{DD}$  pin provides additional transient immunity.

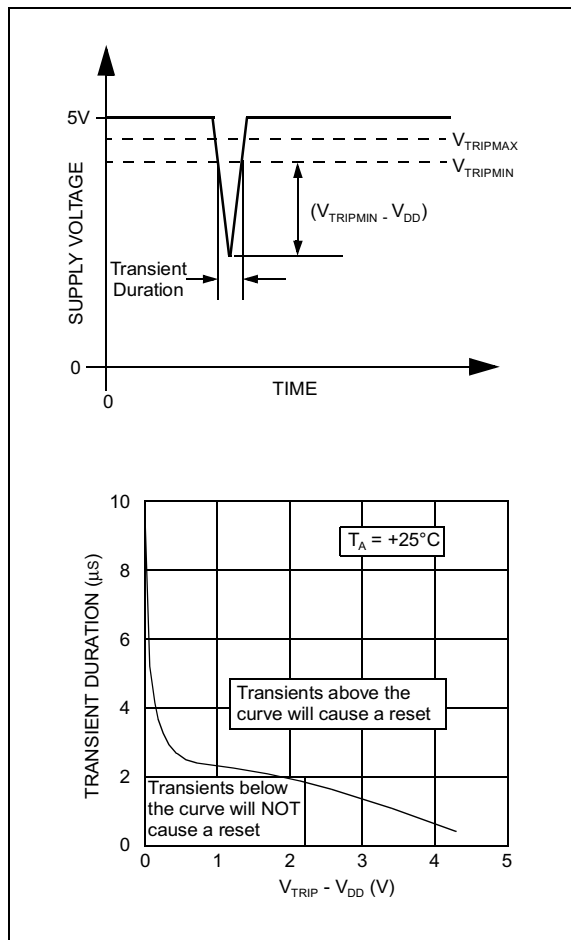


**Figure 2-2:** Typical Transient Response

## 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.

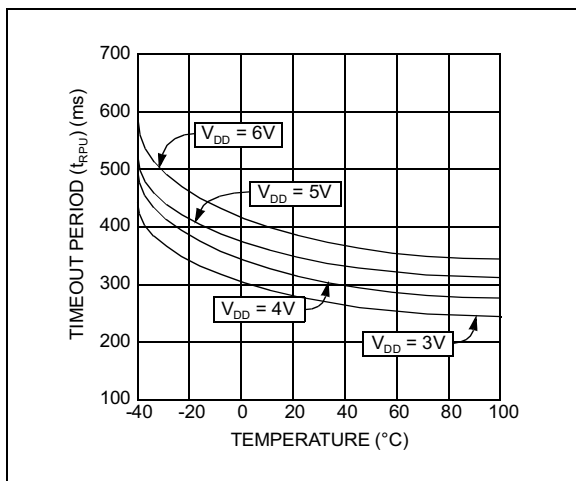


**Figure 2-3:** Typical  $t_{RPU}$  vs. Temperature

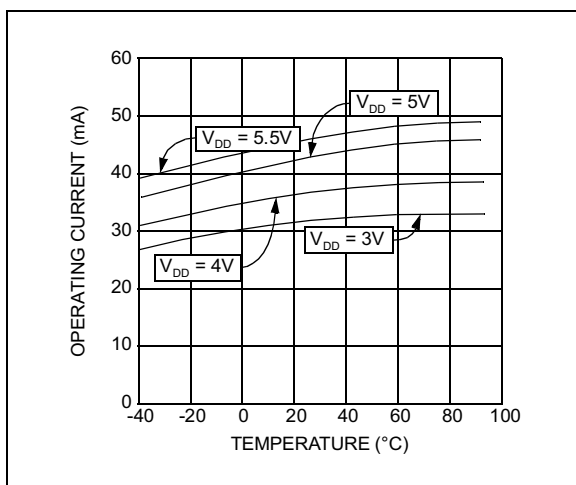


**Figure 2-4:**  $I_{DD}$  vs. Temperature

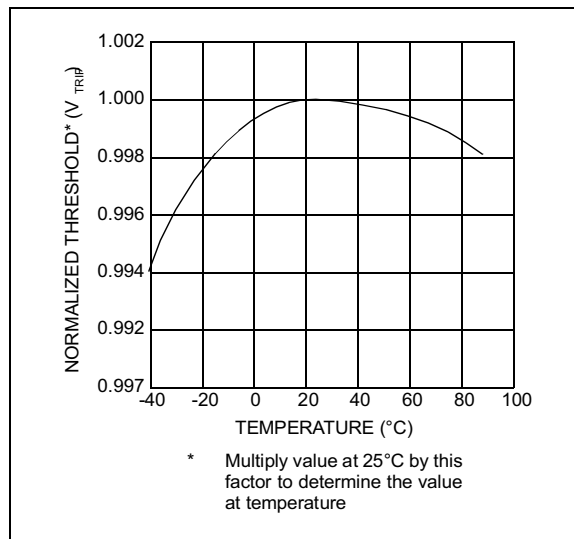


**Figure 2-5:** Normalized  $V_{TRIP}$  vs. Temperature

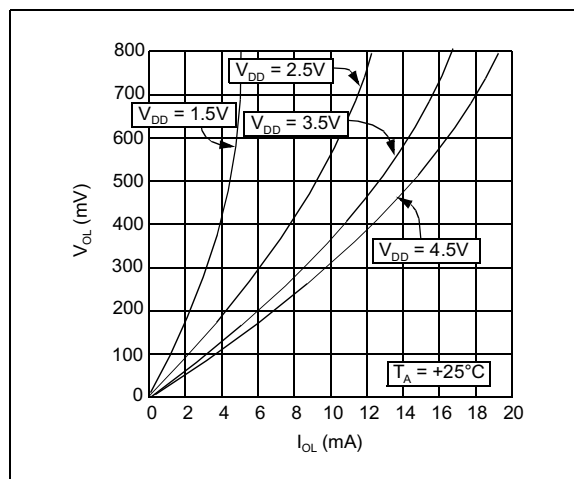
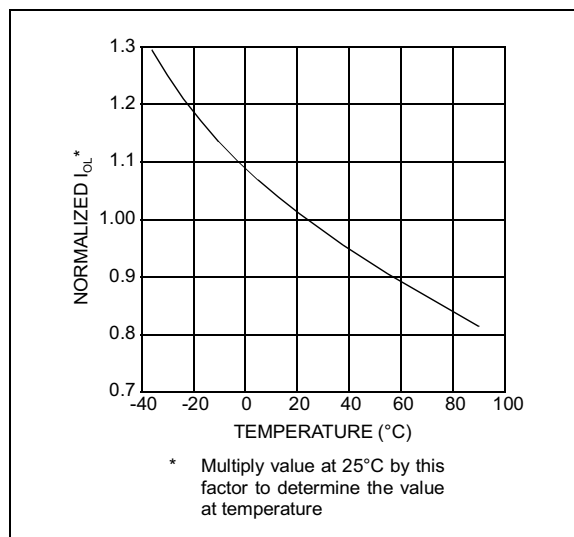


**Figure 2-6:**  $V_{OL}$  vs.  $I_{OL}$



# MCP100/101

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

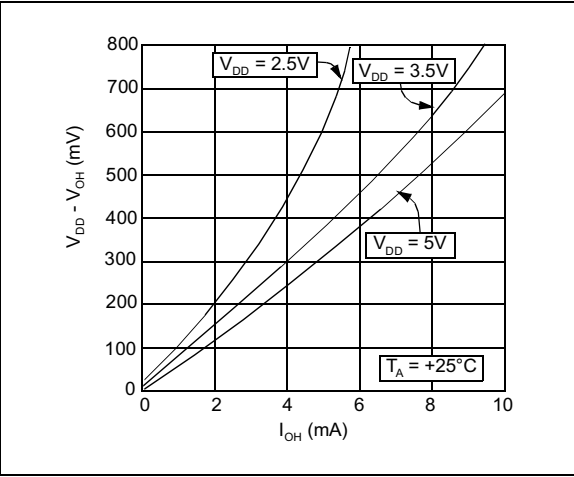


Figure 2-8:  $V_{DD} - V_{OH}$  vs.  $I_{OH}$

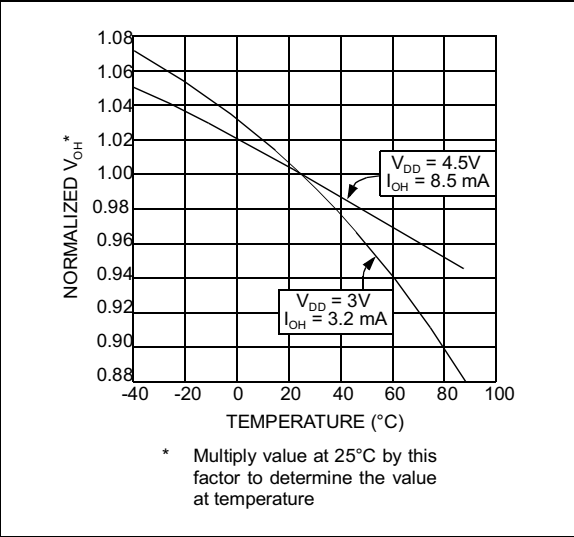


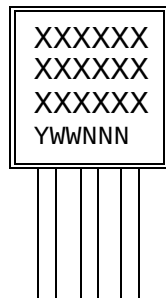
Figure 2-9: Normalized  $V_{OH}$  vs. Temperature

## 3.0 PACKAGING INFORMATION

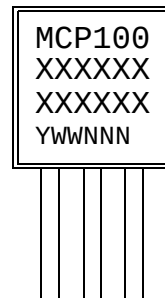
### 3.1 Package Marking Information

ILLUSTRATIONS NOT TO SCALE

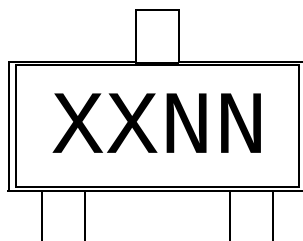
3-Lead Plastic Transistor Outline (TO-92)



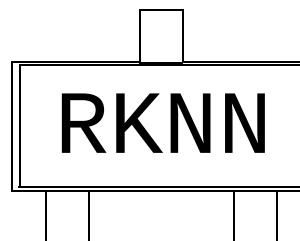
Example:



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 |

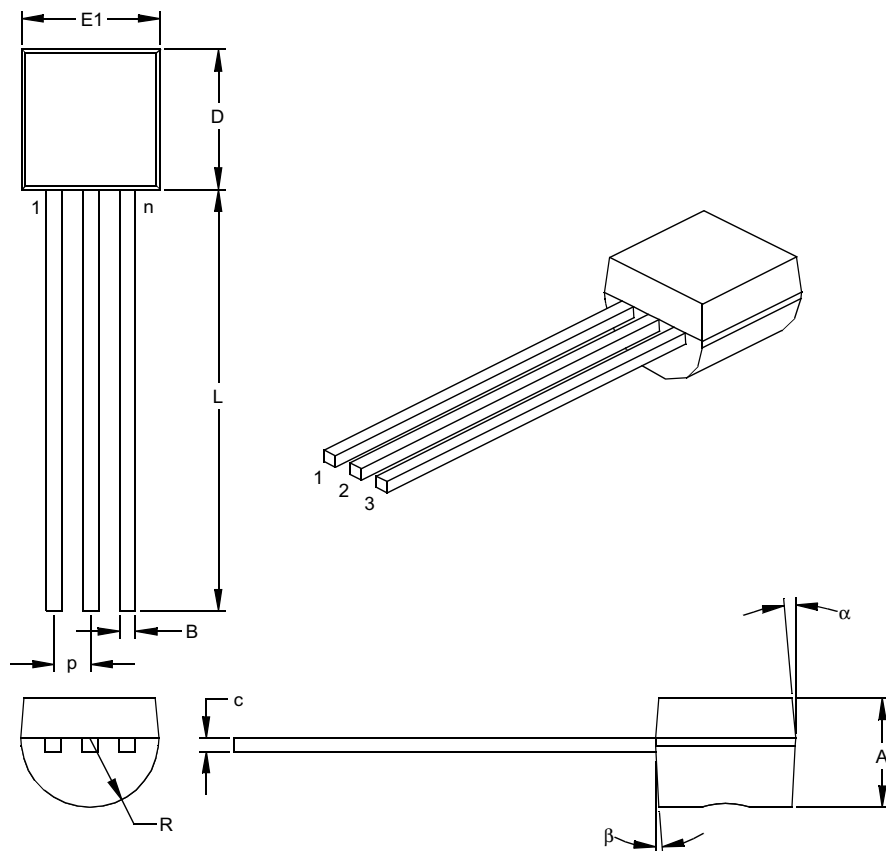
|                |                                                                                                                                                                                                        |                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| <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.

# MCP100/101

## 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

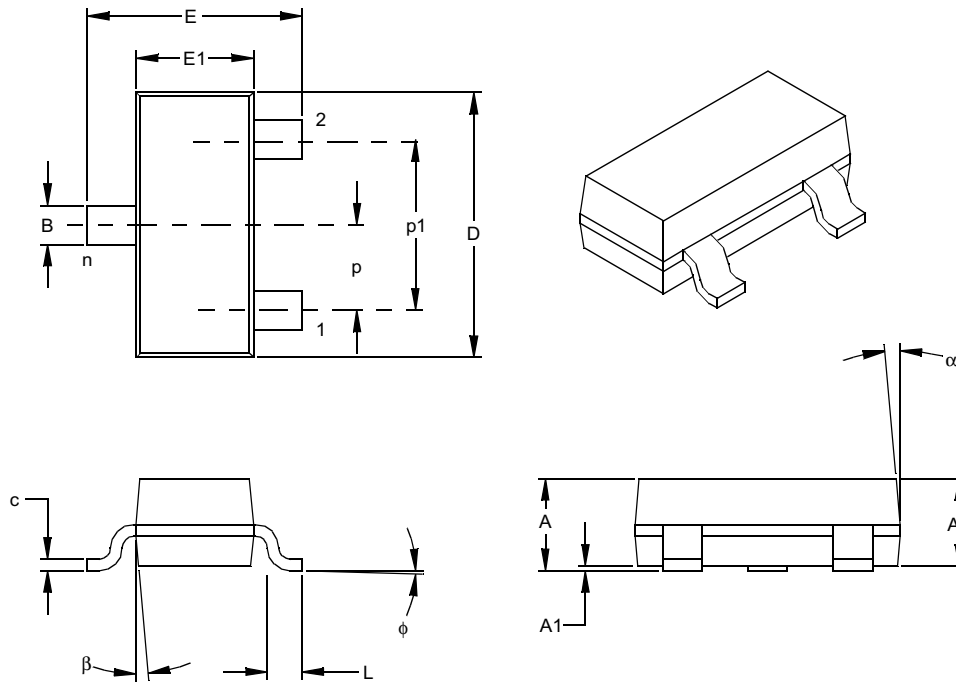
Notes:

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

## 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

# MCP100/101

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NOTES:

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Microchip provides on-line support on the Microchip World Wide Web (WWW) site.

The web site is used by Microchip as a means to make files and information easily available to customers. To view the site, the user must have access to the Internet and a web browser, such as Netscape or Microsoft Explorer. Files are also available for FTP download from our FTP site.

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**[www.microchip.com](http://www.microchip.com)**

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The web site and file transfer site provide a variety of services. Users may download files for the latest Development Tools, Data Sheets, Application Notes, User's Guides, Articles and Sample Programs. A variety of Microchip specific business information is also available, including listings of Microchip sales offices, distributors and factory representatives. Other data available for consideration is:

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- Links to other useful web sites related to Microchip Products
- Conferences for products, Development Systems, technical information and more
- Listing of seminars and events

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013001

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5. What deletions from the data sheet could be made without affecting the overall usefulness?

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7. How would you improve this document?

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8. How would you improve our software, systems, and silicon products?

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## PRODUCT IDENTIFICATION SYSTEM

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

| PART NO.                               | X                                                                                           | X                 | X                    | /XX     |
|----------------------------------------|---------------------------------------------------------------------------------------------|-------------------|----------------------|---------|
| Device                                 | RESET/<br>RESET<br>V <sub>TRIP</sub><br>Voltage                                             | Bondout<br>Option | Temperature<br>Range | Package |
| Device:                                | MCP100: Supervisor circuit with active low $\overline{\text{RESET}}$ output                 |                   |                      |         |
|                                        | MCP100T: Supervisor circuit with active low $\overline{\text{RESET}}$ output (tape & reel)  |                   |                      |         |
|                                        | MCP101: Supervisor circuit with active high $\overline{\text{RESET}}$ output                |                   |                      |         |
|                                        | MCP101T: Supervisor circuit with active high $\overline{\text{RESET}}$ output (tape & reel) |                   |                      |         |
| RESET/RESET V <sub>TRIP</sub> Voltage: | 270 = $2.55 \leq V_{\text{TRIP}} \leq 2.70$                                                 |                   |                      |         |
|                                        | 300 = $2.85 \leq V_{\text{TRIP}} \leq 3.00$                                                 |                   |                      |         |
|                                        | 315 = $3.00 \leq V_{\text{TRIP}} \leq 3.15$                                                 |                   |                      |         |
|                                        | 450 = $4.25 \leq V_{\text{TRIP}} \leq 4.50$                                                 |                   |                      |         |
|                                        | 460 = $4.35 \leq V_{\text{TRIP}} \leq 4.60$                                                 |                   |                      |         |
|                                        | 475 = $4.50 \leq V_{\text{TRIP}} \leq 4.75$                                                 |                   |                      |         |
|                                        | 485 = $4.60 \leq V_{\text{TRIP}} \leq 4.85$                                                 |                   |                      |         |
| 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:**

a) MCP100-270DI/TO = V<sub>TRIP</sub> range of 2.55V - 2.70V, Bonding Option D, Industrial Temp., TO-92 package

b) MCP100T-450I/TT = V<sub>TRIP</sub> range of 4.25V - 4.50V, Industrial Temp., SOT-23 package

c) MCP101-270HI/TO = V<sub>TRIP</sub> range of 2.55V - 2.70V, Bonding Option H, Industrial Temp., TO-92 package

d) MCP101T-315I/TT = V<sub>TRIP</sub> range of 3.00V - 3.15V, Industrial Temp., SOT-23 package

TO-92 with 'D' Bondout

TO-92 with 'H' Bondout

SOT-23-3

## 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:

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2. The Microchip Corporate Literature Center U.S. FAX: (480) 792-7277
3. The Microchip Worldwide Site ([www.microchip.com](http://www.microchip.com))

Please specify which device, revision of silicon and Data Sheet (include Literature #) you are using.

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# MCP100/101

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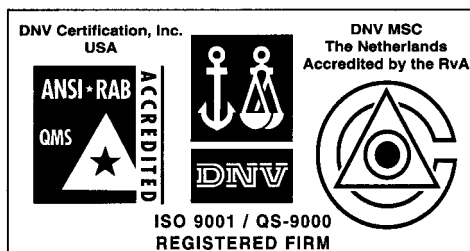
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08/01/01

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