# MCP809/810

## Microcontroller Supervisory Circuit with Push-Pull Output

### Features

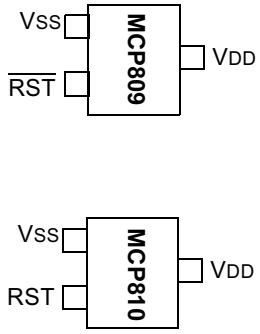
- Holds microcontroller in reset until supply voltage reaches stable operating level
- Resets microcontroller during power loss
- Precision monitoring of 3V, 3.3V and 5V systems
- 7 voltage trip points available
- Active low $\overline{\text{RESET}}$ pin (MCP809) or active high RESET (MCP810)
- Push-pull 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°C to +85°C

### DESCRIPTION

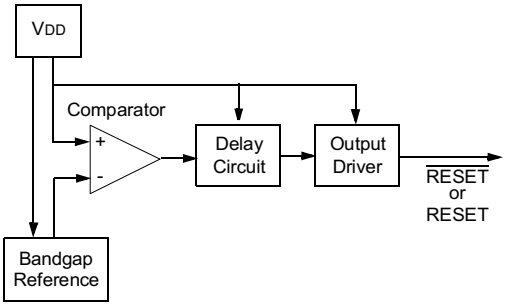
The Microchip Technology Inc. MCP809/810 is a voltage supervisory device designed to keep a microcontroller in reset until the system voltage has reached the proper level and stabilized. It also operates as protection from brown-out conditions when the supply voltage drops below a safe operating level. Both devices are available with a choice of seven different trip voltages and both have push-pull outputs. The MCP809 has a low active $\overline{\text{RESET}}$ pin and the MCP810 has a high active RESET pin. The MCP809/810 will assert the $\overline{\text{RESET}}$/RESET signal whenever the voltage on the $V_{DD}$ pin is below the trip-point voltage.

### Packages

**SOT-23-3**




### BLOCK DIAGRAM




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## 1.0 ELECTRICAL CHARACTERISTICS

### 1.1 Maximum Ratings*

VDD.....7.0V

All inputs and outputs w.r.t. VSS .....-0.6V to VDD +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<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 | µA | $V_{DD}$ = 5.5V (no load) |
| $V_{DD}$ Trip Point | MCP8XX-270<br>MCP8XX-300<br>MCP8XX-315<br>MCP8XX-450<br>MCP8XX-460<br>MCP8XX-475<br>MCP8XX-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 (MCP809) | MCP809-270<br>MCP809-300<br>MCP809-315 | $V_{OL}$ | — | — | 0.4 | V | $I_{OL}$ = 3.2 mA,<br>$V_{DD}$ = $V_{TRIP_{MIN}}$ |
| | MCP809-450<br>MCP809-460<br>MCP809-475<br>MCP809-485 | | — | — | 0.6 | | $I_{OL}$ = 8.5 mA,<br>$V_{DD}$ = $V_{TRIP_{MIN}}$ |
| $\overline{RESET}$ High Level Output Voltage (MCP809) | MCP809-xxx<br>(All $V_{TRIP}$ Points) | $V_{OH}$ | VDD-0.7 | — | — | V | $I_{OH}$ = 3 mA,<br>$V_{DD}$ > $V_{TRIP_{MAX}}$ |
| RESET Low Level Output Voltage (MCP810) | MCP810-270<br>MCP810-300<br>MCP810-315 | $V_{OL}$ | — | — | 0.4 | V | $I_{OL}$ = 3.2 mA,<br>$V_{DD}$ > $V_{TRIP_{MAX}}$ |
| | MCP810-450<br>MCP810-460<br>MCP810-475<br>MCP810-485 | | — | — | 0.6 | | $I_{OL}$ = 8.5 mA,<br>$V_{DD}$ > $V_{TRIP_{MAX}}$ |
| RESET High Level Output Voltage (MCP810) | MCP810-xxx<br>(All VTRIP Points) | $V_{OH}$ | $V_{DD}$-0.7 | — | — | V | $I_{OH}$ = 3 mA,<br>$V_{DD}$ = $V_{TRIP_{MIN}}$ |
| 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 $V_{TRPMAX}$ + 250 mV down to $V_{TRIPMIN}$ - 250 mV |


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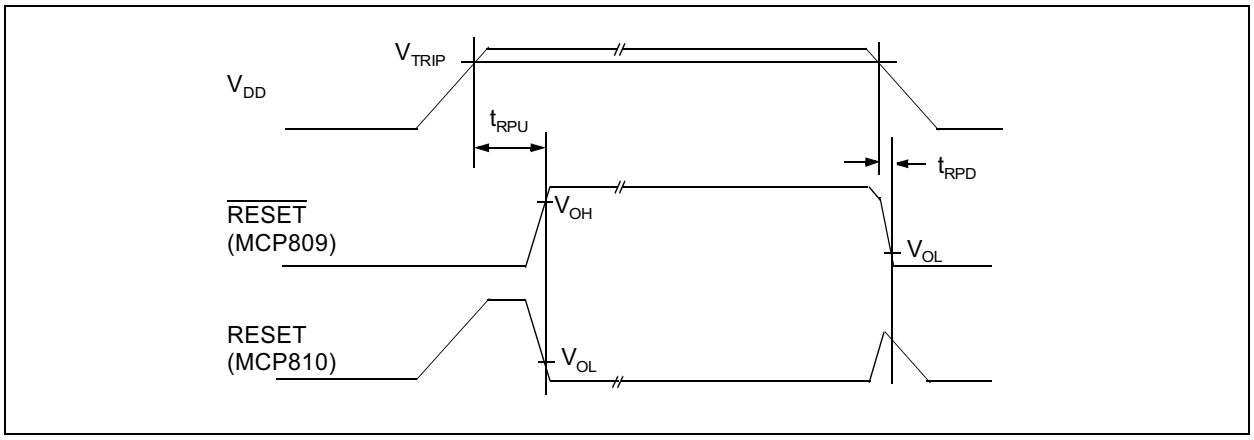



**FIGURE 1-1:** MCP809/810 TIMING DIAGRAM

## 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.

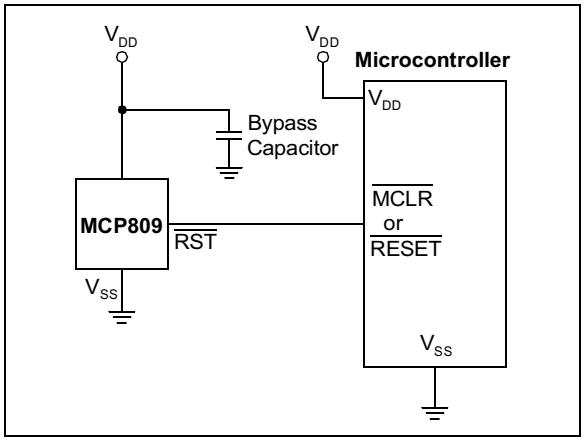



**FIGURE 2-1:** TYPICAL APPLICATION

### 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  shows typical transient duration vs. reset comparator overdrive for which the MCP809/810 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.

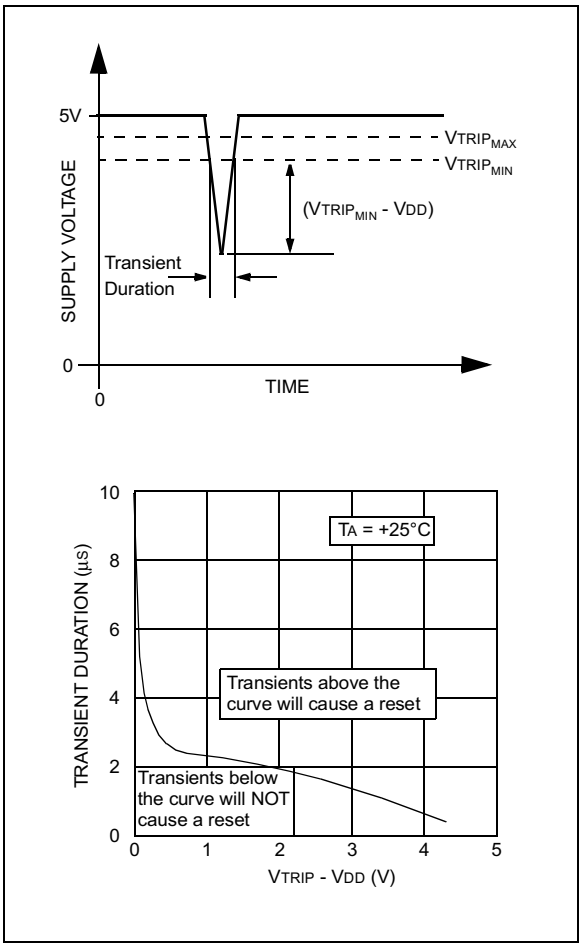



**FIGURE 2-2:** TYPICAL TRANSIENT RESPONSE


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### 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.

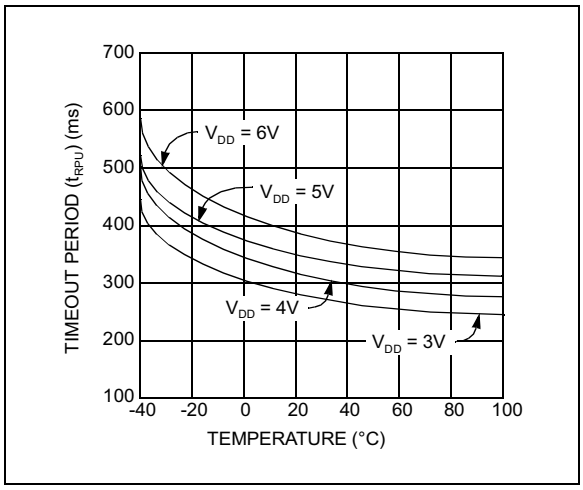



**FIGURE 2-3:** TYPICAL $T_{RPU}$ VS. TEMPERATURE

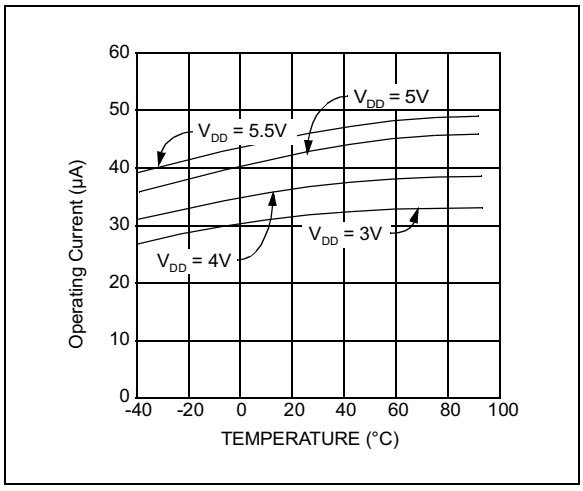



**FIGURE 2-4:** $I_{DD}$ VS. TEMPERATURE

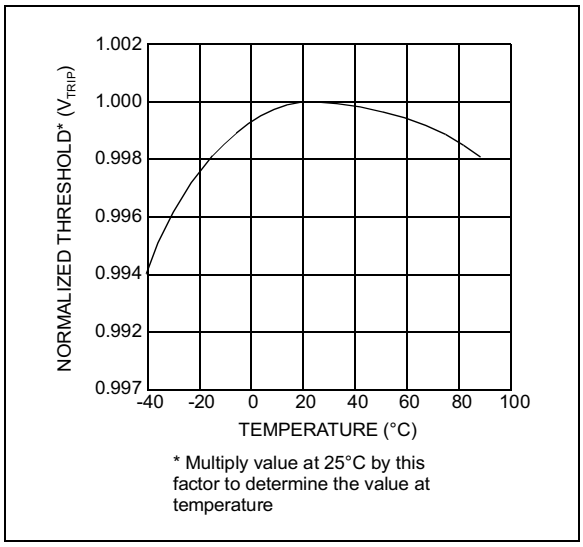



**FIGURE 2-5:** NORMALIZED $V_{TRIP}$ VS. TEMPERATURE

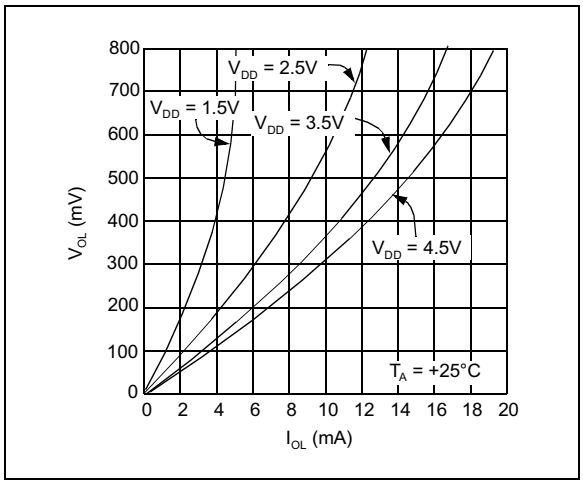



**FIGURE 2-6:** $V_{OL}$ VS. $I_{OL}$

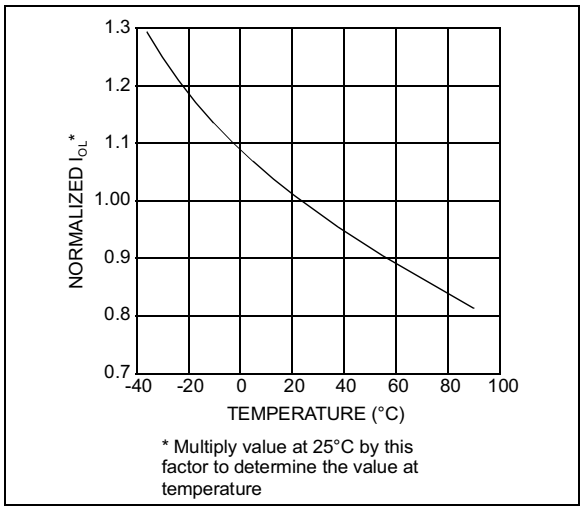



**FIGURE 2-7:** NORMALIZED $I_{OL}$ vs. TEMPERATURE

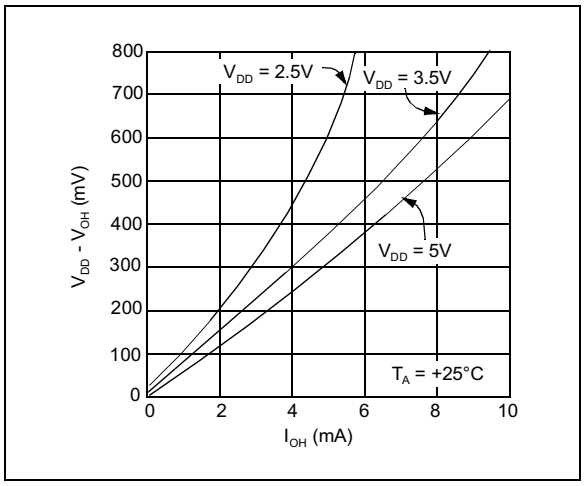



**FIGURE 2-8:** $V_{DD}$ - $V_{OH}$ *vs.* $I_{OH}$

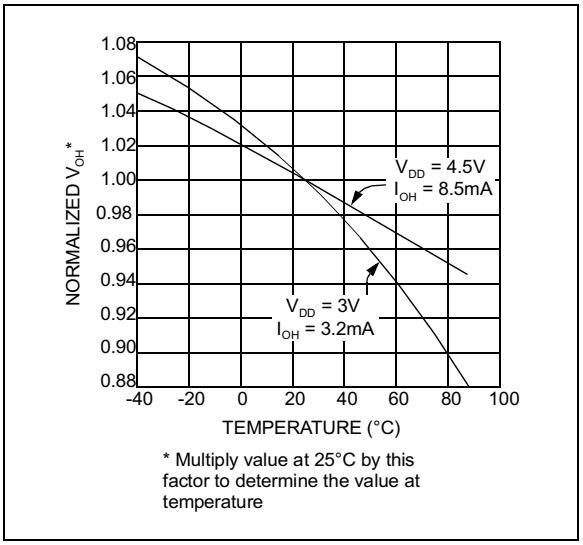


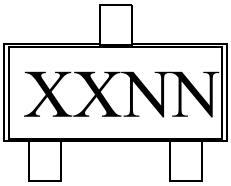

**FIGURE 2-9:** NORMALIZED $V_{OH}$ vs. TEMPERATURE


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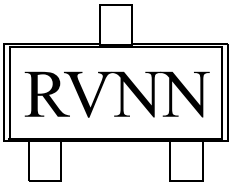
# 3.0 PACKAGING INFORMATION

## 3.1 Package Marking Information

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 |
|---|---|---|---|
| QR | MCP809T-270I/TT | RR | MCP810T-270I/TT |
| QS | MCP809T-300I/TT | RS | MCP810T-300I/TT |
| QT | MCP809T-315I/TT | RT | MCP810T-315I/TT |
| QU | MCP809T-450I/TT | RU | MCP810T-450I/TT |
| QV | MCP809T-460I/TT | RV | MCP810T-460I/TT |
| QW | MCP809T-475I/TT | RW | MCP810T-475I/TT |
| QZ | MCP809T-485I/TT | RZ | MCP810T-485I/TT |

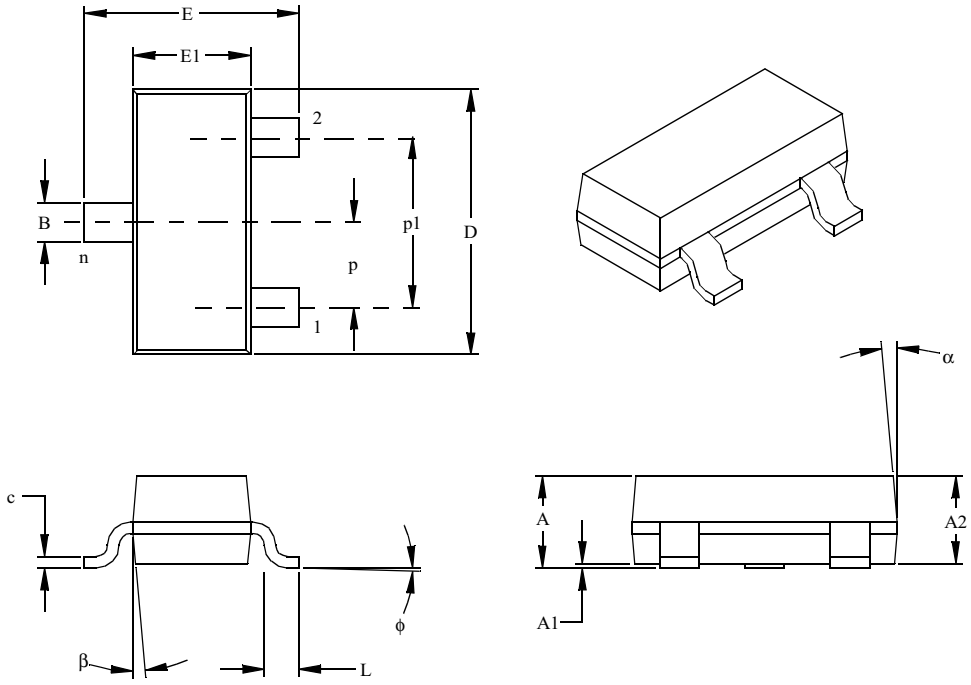
| | | |
|---|---|---|
| **Legend:** | XX...X | Customer specific information* |
| | YY | Year code (last 2 digits of calendar year) |
| | WW | Week code (week of January 1 is week ‘01’) |
| | NNN | Alphanumeric traceability code |

**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 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

**Note:**
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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## 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 | /XX |
|---|---|---|---|
| Device | RESET/ $\overline{\text{RESET}}$ $V_{TRIP}$ Voltage | Temperature Range | Package |

| | | |
|---|---|---|
| Device: | MCP809T: | Supervisory circuit with active low $\overline{\text{RESET}}$ output (tape & reel) |
| | MCP810T: | Supervisory circuit with active high $\overline{\text{RESET}}$ output (tape & reel) |
| $\overline{\text{RESET}}$/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 = | $4.60 \le V_{TRIP} \le 4.85$ |
| Temperature Range: | I = | -40°C to +85°C |
| Package: | TT = | SOT-23 (3 lead) (offered in tape & reel only) |

**Examples:**

a) MCP809T–270I/TT = Tape & Reel, $V_{TRIP}$ range of 2.55V - 2.70V, Industrial Temp., SOT-23 package

b) MCP810T-300/TT = Tape & Reel, $V_{TRIP}$ range of 2.85V - 3.00V, Industrial Temp., SOT-23 package

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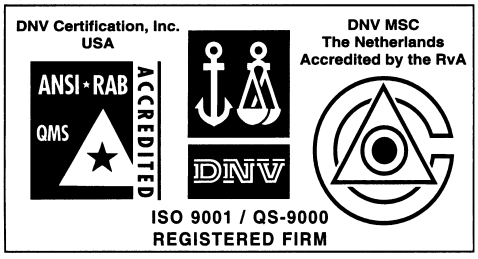
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