# MCP111/112

## Micropower Voltage Detector

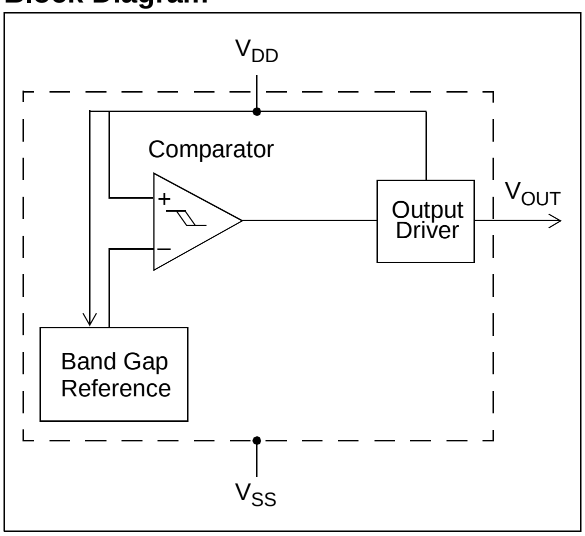
### Features

- Ultra-low supply current: 1.75 µA (max.)
- Precision monitoring options of:
  - 1.90V, 2.32V, 2.63V, 2.90V, 2.93V, 3.08V, 4.38V and 4.63V
- Resets microcontroller in a power-loss event
- Active-low $V_{OUT}$ pin:
  - **MCP111** active-low, open-drain
  - **MCP112** active-low, push-pull
- Available in SOT23-3, TO-92 and SC70 packages
- Temperature Range:
  - Extended: –40°C to +125°C (**except MCP1XX-195**)
  - Industrial: –40°C to +85°C (**MCP1XX-195 only**)

### Applications

- Critical µC and µP Power-monitoring Applications
- Computers
- Intelligent Instruments
- Portable Battery-Powered Equipment

### Block Diagram




### Description

The MCP111/112 are voltage-detecting devices designed to keep a microcontroller in reset until the system voltage has reached, and stabilized, at the appropriate level for reliable system operation. These devices also operate as protection from brown-out conditions when the system supply voltage drops below a safe operating level. The MCP111 and MCP112 are available in eight different trip voltages.

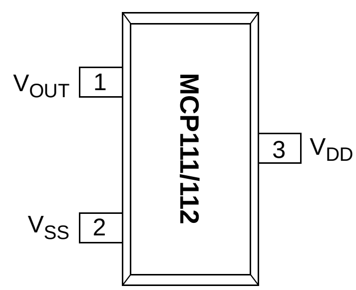
The MCP111 has an open-drain output with an active-low pin ($V_{OUT}$). This device will assert $V_{OUT}$ when the voltage on the $V_{DD}$ pin is below the trip-point voltage.

The MCP112 has a push-pull output and will assert an active-low signal ($V_{OUT}$ pin) when the voltage on the $V_{DD}$ pin is below the trip-point voltage.

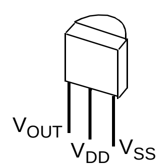
During operation, the output ($V_{OUT}$) remains at a logic-high as long as $V_{DD}$ is greater than the specified threshold voltage. When $V_{DD}$ falls below the voltage trip point, $V_{OUT}$ is driven low.

### Package Types

**SOT23-3/SC-70**




**TO-92**



## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings†

$V_{DD}$ . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 7.0V
Input current ($V_{DD}$) . . . . . . . . . . . . . . . . . . . . . . . . . . . .10 mA
Output current ($\overline{RST}$) . . . . . . . . . . . . . . . . . . . . . . . . .10 mA
Rated Rise Time of $V_{DD}$ . . . . . . . . . . . . . . . . . . . . . . 100V/µs
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 . . . . . . .–40°C to + 125°C
Maximum Junction temp. with power applied . . . . . . . .150°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 CHARACTERISTICS

**Electrical Specifications:** Unless otherwise indicated, all limits are specified for $V_{DD}$ = 1V to 5.5V, $R_{PU}$ = 100 kΩ (only **MCP111**), $T_A$ = –40°C to +125°C.

| Parameters | | Sym | Min | Typ | Max | Units | Conditions |
|---|---|---|---|---|---|---|---|
| Operating Voltage Range | | $V_{DD}$ | 1.0 | — | 5.5 | V | |
| Specified $V_{DD}$ Value to $V_{OUT}$ low | | $V_{DD}$ | 1.0 | — | | V | $I_{\overline{RST}}$ = 10 µA, $V_{\overline{RST}}$ < 0.2V |
| Operating Current | | $I_{DD}$ | — | < 1 | 1.75 | µA | |
| $V_{DD}$ Trip Point | **MCP1XX-195** | $V_{TRIP}$ | 1.872 | 1.900 | 1.929 | V | $T_A$ = +25°C **(Note 1)** |
| | | | 1.853 | 1.900 | 1.948 | V | $T_A$ = -40°C to +85°C **(Note 2)** |
| | **MCP1XX-240** | | 2.285 | 2.320 | 2.355 | V | $T_A$ = +25°C **(Note 1)** |
| | | | 2.262 | 2.320 | 2.378 | V | **Note 2** |
| | **MCP1XX-270** | | 2.591 | 2.630 | 2.670 | V | $T_A$ = +25°C **(Note 1)** |
| | | | 2.564 | 2.630 | 2.696 | V | **Note 2** |
| | **MCP1XX-290** | | 2.857 | 2.900 | 2.944 | V | $T_A$ = +25°C **(Note 1)** |
| | | | 2.828 | 2.900 | 2.973 | V | **Note 2** |
| | **MCP1XX-300** | | 2.886 | 2.930 | 2.974 | V | $T_A$ = +25°C **(Note 1)** |
| | | | 2.857 | 2.930 | 3.003 | V | **Note 2** |
| | **MCP1XX-315** | | 3.034 | 3.080 | 3.126 | V | $T_A$ = +25°C **(Note 1)** |
| | | | 3.003 | 3.080 | 3.157 | V | **Note 2** |
| | **MCP1XX-450** | | 4.314 | 4.380 | 4.446 | V | $T_A$ = +25°C **(Note 1)** |
| | | | 4.271 | 4.380 | 4.490 | V | **Note 2** |
| | **MCP1XX-475** | | 4.561 | 4.630 | 4.700 | V | $T_A$ = +25°C **(Note 1)** |
| | | | 4.514 | 4.630 | 4.746 | V | **Note 2** |
| $V_{DD}$ Trip Point Tempco | | $T_{TPCO}$ | — | ±100 | — | ppm/°C | |
| Threshold Hysteresis (min. = 1%, max = 6%) | **MCP1XX-195** | $V_{HYS}$ | 0.019 | — | 0.114 | V | $T_A$ = +25°C |
| | **MCP1XX-240** | | 0.023 | — | 0.139 | V | |
| | **MCP1XX-270** | | 0.026 | — | 0.158 | V | |
| | **MCP1XX-290** | | 0.029 | — | 0.174 | V | |
| | **MCP1XX-300** | | 0.029 | — | 0.176 | V | |
| | **MCP1XX-315** | | 0.031 | — | 0.185 | V | |
| | **MCP1XX-450** | | 0.044 | — | 0.263 | V | |
| | **MCP1XX-475** | | 0.046 | — | 0.278 | V | |

**Note 1:** Trip point is ±1.5% from typical value.
**2:** Trip point is ±2.5% from typical value.

## DC CHARACTERISTICS (CONTINUED)

**Electrical Specifications:** Unless otherwise indicated, all limits are specified for $V_{DD}$ = 1V to 5.5V, $R_{PU}$ = 100 kΩ (only **MCP111**), $T_A$ = –40°C to +125°C.

| Parameters | Sym | Min | Typ | Max | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{OUT}$ Low-level Output Voltage | $V_{OL}$ | — | — | 0.4 | V | $I_{OL}$ = 500 µA, $V_{DD}$ = $V_{TRIP(MIN)}$ |
| $V_{OUT}$ High-level Output Voltage | $V_{OH}$ | $V_{DD}$ – 0.6 | — | — | V | $I_{OH}$ = 1 mA, For only **MCP112** (push-pull output) |
| Open-Drain Output Leakage Current (**MCP111** only) | $I_{OD}$ | — | 0.1 | — | µA | |

**Note 1:** Trip point is ±1.5% from typical value.

**2:** Trip point is ±2.5% from typical value.

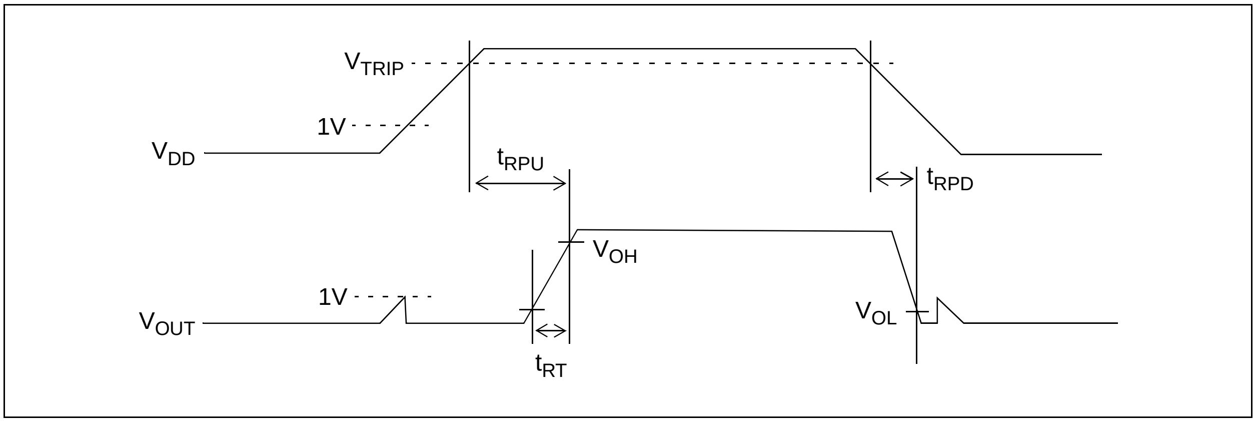



***FIGURE 1-1:*** *Timing Diagram.*

## AC CHARACTERISTICS

**Electrical Specifications:** Unless otherwise indicated, all limits are specified for $V_{DD}$ = 1V to 5.5V, $R_{PU}$ = 100 kΩ (only **MCP111**), $T_A$ = –40°C to +125°C.

| Parameters | Sym | Min | Typ | Max | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{DD}$ Detect to $V_{OUT}$ Inactive | $t_{RPU}$ | — | 90 | — | µs | **Figure 1-1** and $C_L$ = 50 pF **(Note 1)** |
| $V_{DD}$ Detect to $V_{OUT}$ Active | $t_{RPD}$ | — | 130 | — | µs | $V_{DD}$ ramped from $V_{TRIP(MAX)}$ + 250 mV down to $V_{TRIP(MIN)}$ – 250 mV, per **Figure 1-1**, $C_L$ = 50 pF **(Note 1)** |
| $V_{OUT}$ Rise Time After $V_{OUT}$ Active | $t_{RT}$ | — | 5 | — | µs | For $V_{OUT}$ 10% to 90% of final value per **Figure 1-1**, $C_L$ = 50 pF **(Note 1)** |

**Note 1:** These parameters are for design guidance only and are not 100% tested.

## TEMPERATURE CHARACTERISTICS

| **Electrical Specifications:** Unless otherwise noted, all limits are specified for $V_{DD}$ = 1V to 5.5V, $R_{PU}$ = 100 kΩ (only **MCP111**), $T_A$ = –40°C to +125°C. | | | | | | |
|---|---|---|---|---|---|---|
| **Parameters** | **Sym** | **Min** | **Typ** | **Max** | **Units** | **Conditions** |
| **Temperature Ranges** | | | | | | |
| Specified Temperature Range | $T_A$ | –40 | — | +85 | °C | **MCP1XX-195** |
| Specified Temperature Range | $T_A$ | –40 | — | +125 | °C | Except **MCP1XX-195** |
| Maximum Junction Temperature | $T_J$ | — | — | +150 | °C | |
| Storage Temperature Range | $T_A$ | –65 | — | +150 | °C | |
| **Package Thermal Resistances** | | | | | | |
| Thermal Resistance, 3L-SOT23 | $\theta_{JA}$ | — | 336 | — | °C/W | |
| Thermal Resistance, 3L-SC-70 | $\theta_{JA}$ | — | 340 | — | °C/W | |
| Thermal Resistance, 3L-TO92 | $\theta_{JA}$ | — | 131.9 | — | °C/W | |

## 2.0 TYPICAL PERFORMANCE CURVES

| | |
|---|---|
| **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. |

**Note:** Unless otherwise indicated, all limits are specified for $V_{DD}$ = 1V to 5.5V, $R_{PU}$ = 100 kΩ (only **MCP111**; see **Figure 4-1**), $T_A$ = –40°C to +125°C.

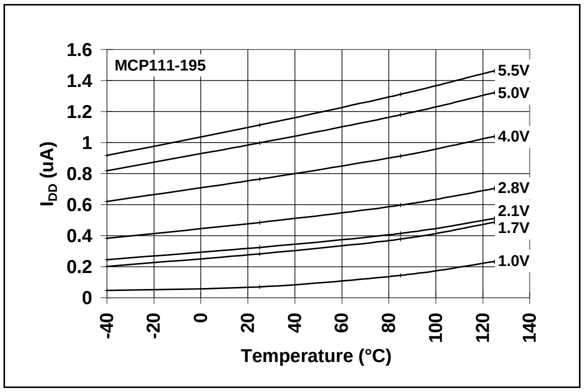



*FIGURE 2-1: $I_{DD}$ vs. Temperature (**MCP111-195**).*

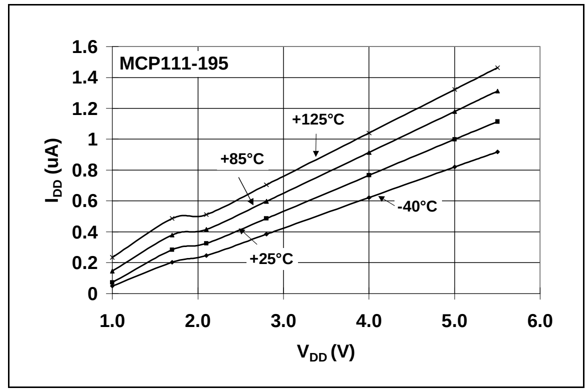



*FIGURE 2-4: $I_{DD}$ vs. $V_{DD}$ (**MCP111-195**).*

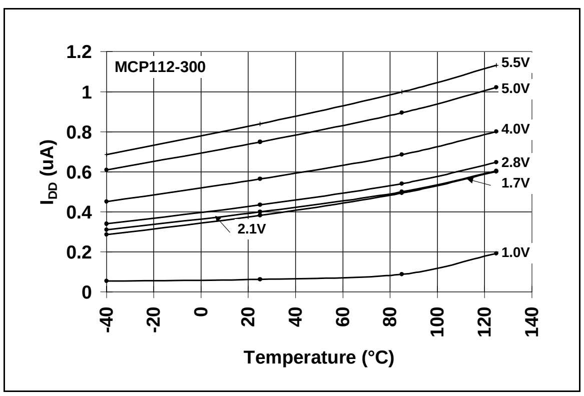



*FIGURE 2-2: $I_{DD}$ vs. Temperature (**MCP112-300**).*

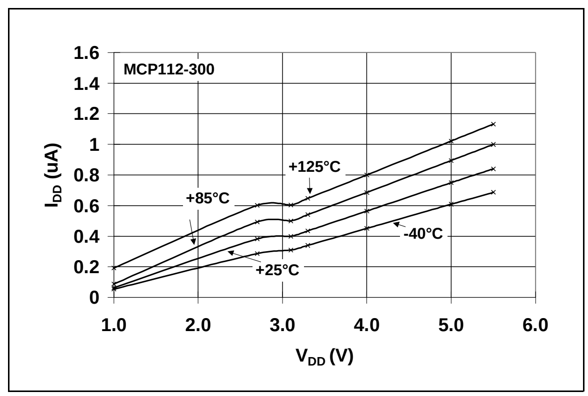



*FIGURE 2-5: $I_{DD}$ vs. $V_{DD}$ (**MCP112-300**).*

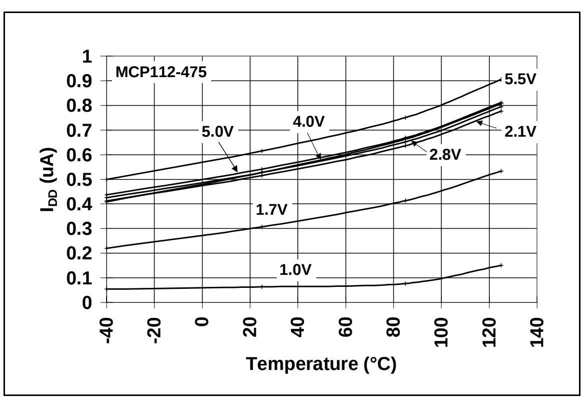



*FIGURE 2-3: $I_{DD}$ vs. Temperature (**MCP112-475**).*

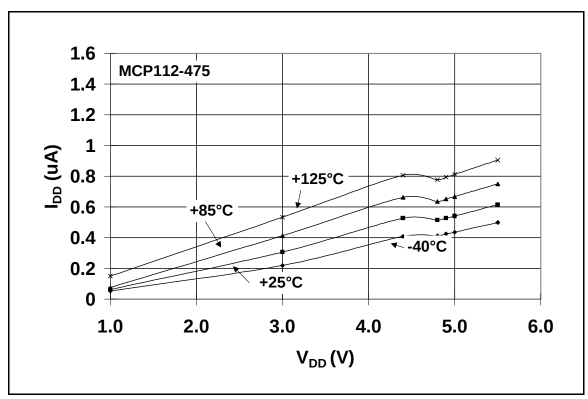



*FIGURE 2-6: $I_{DD}$ vs. $V_{DD}$ (**MCP112-475**).*

**Note:** Unless otherwise indicated, all limits are specified for $V_{DD}$ = 1V to 5.5V, $R_{PU}$ = 100 kΩ (only **MCP111**; see **Figure 4-1**), $T_A$ = –40°C to +125°C.

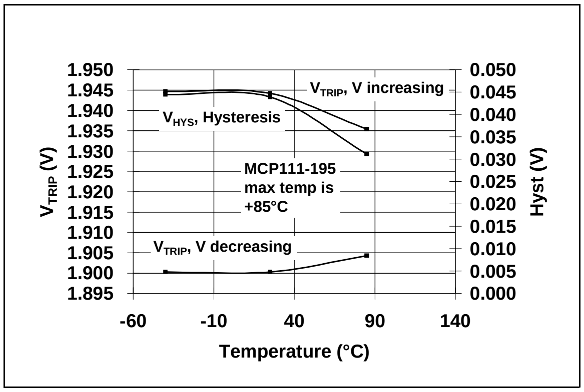



***FIGURE 2-7:*** *$V_{TRIP}$ and $V_{HYST}$ vs. Temperature (**MCP111-195**).*

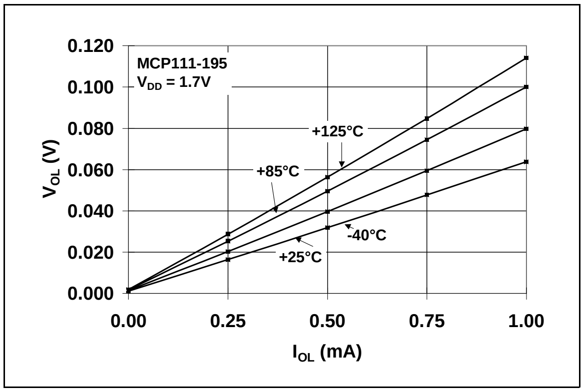



***FIGURE 2-10:*** *$V_{OL}$ vs. $I_{OL}$ (**MCP111-195** @ $V_{DD}$ = 1.7V).*

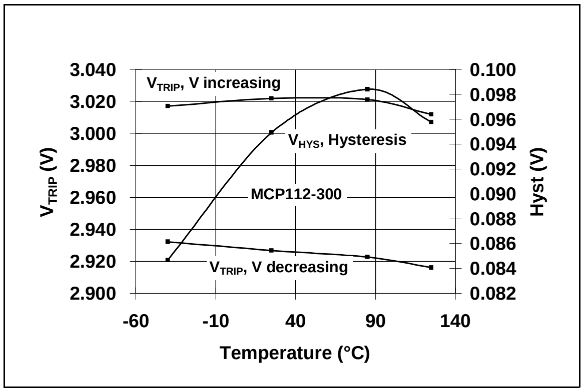



***FIGURE 2-8:*** *$V_{TRIP}$ and $V_{HYST}$ vs. Temperature (**MCP112-300**).*

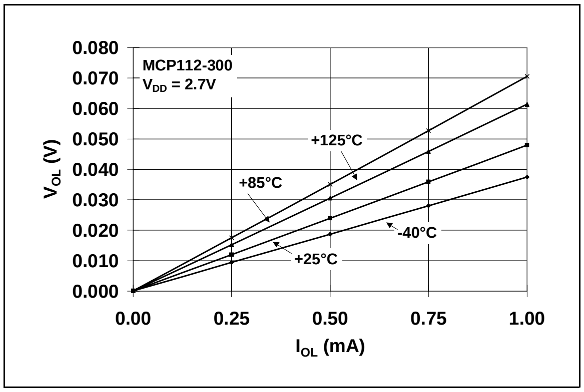



***FIGURE 2-11:*** *$V_{OL}$ vs. $I_{OL}$ (**MCP112-300** @ $V_{DD}$ = 2.7V).*

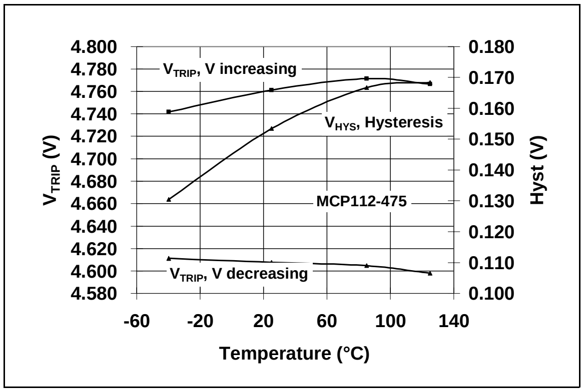



***FIGURE 2-9:*** *$V_{TRIP}$ and $V_{HYST}$ vs. Temperature (**MCP112-475**).*

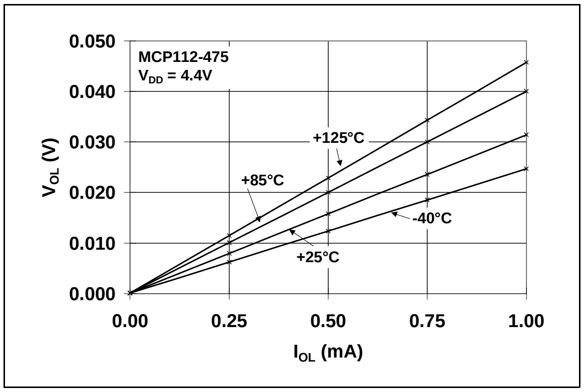



***FIGURE 2-12:*** *$V_{OL}$ vs. $I_{OL}$ (**MCP112-475** @ $V_{DD}$ = 4.4V).*

**Note:** Unless otherwise indicated, all limits are specified for $V_{DD}$ = 1V to 5.5V, $R_{PU}$ = 100 kΩ (**only MCP111**; see **Figure 4-1**), $T_A$ = –40°C to +125°C.

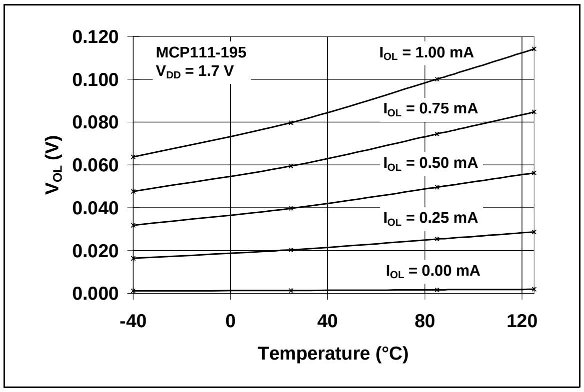



***FIGURE 2-13:*** *$V_{OL}$ vs. Temperature (**MCP111-195** @ $V_{DD}$ = 1.7V).*

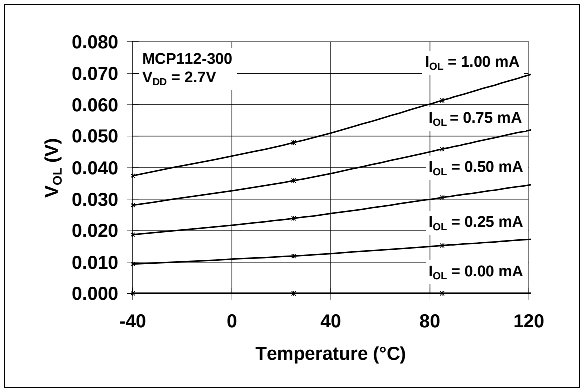



***FIGURE 2-14:*** *$V_{OL}$ vs. Temperature (**MCP112-300** @ $V_{DD}$ = 2.7V).*

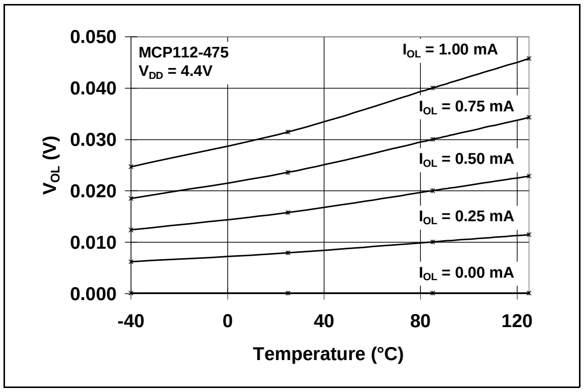



***FIGURE 2-15:*** *$V_{OL}$ vs. Temperature (**MCP112-475** @ $V_{DD}$ = 4.4V).*

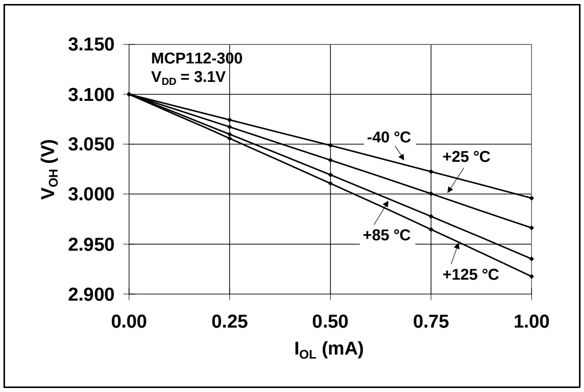



***FIGURE 2-16:*** *$V_{OH}$ vs. $I_{OH}$ (**MCP112-300** @ $V_{DD}$ = 3.1V).*

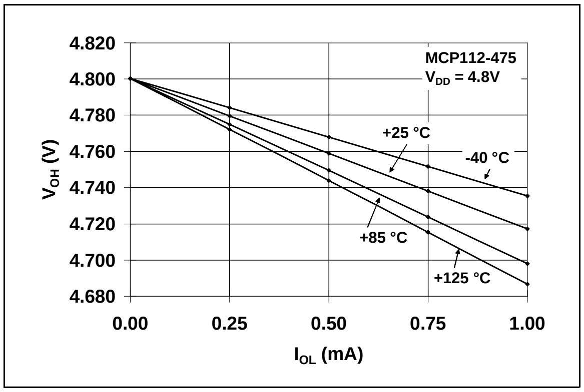



***FIGURE 2-17:*** *$V_{OH}$ vs. $I_{OH}$ (**MCP112-475** @ $V_{DD}$ = 4.8V).*

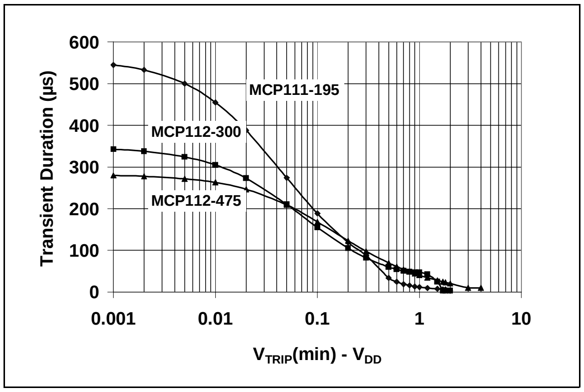



***FIGURE 2-18:*** *Typical Transient Response (25 °C).*

**Note:** Unless otherwise indicated, all limits are specified for $V_{DD}$ = 1V to 5.5V, $R_{PU}$ = 100 kΩ (**only MCP111**; see **Figure 4-1**), $T_A$ = –40°C to +125°C.

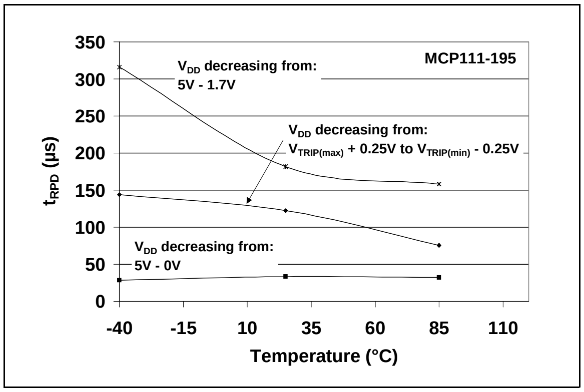



***FIGURE 2-19:*** *$t_{RPD}$ vs. Temperature (**MCP111-195**).*

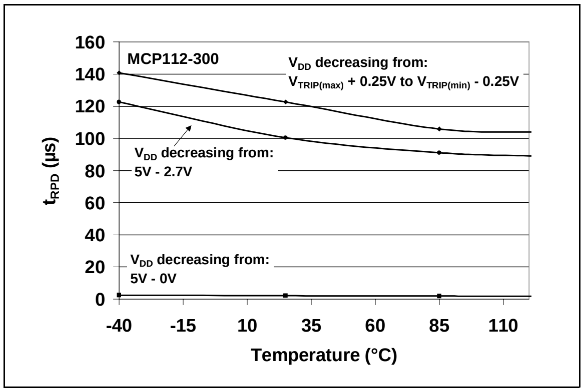



***FIGURE 2-20:*** *$t_{RPD}$ vs. Temperature (**MCP112-300**).*

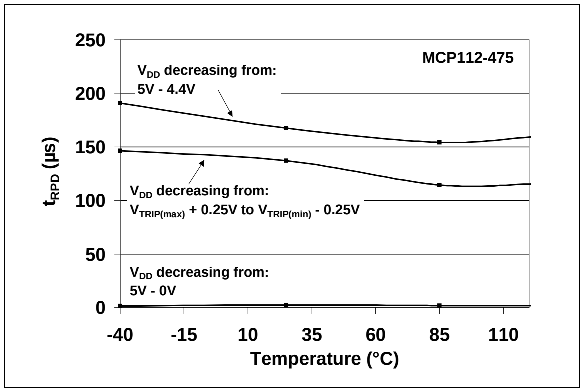



***FIGURE 2-21:*** *$t_{RPD}$ vs. Temperature (**MCP112-475**).*

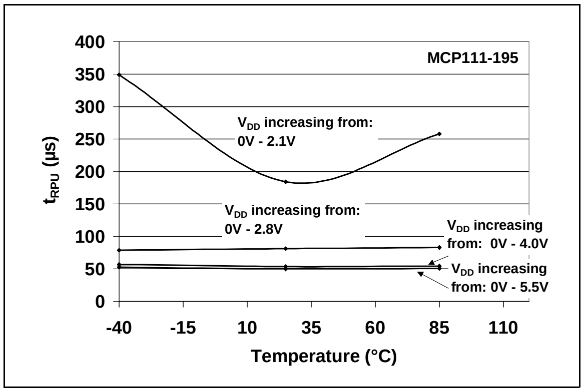



***FIGURE 2-22:*** *$t_{RPU}$ vs. Temperature (**MCP111-195**).*

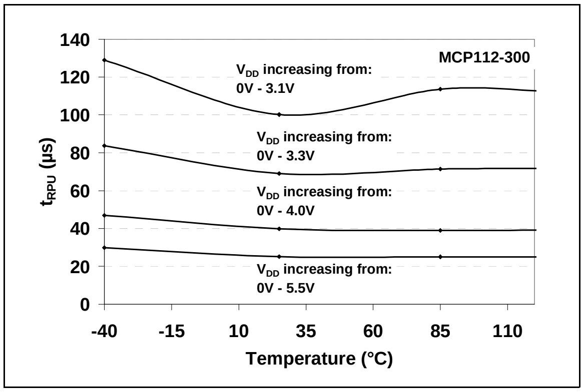



***FIGURE 2-23:*** *$t_{RPU}$ vs. Temperature (**MCP112-300**).*

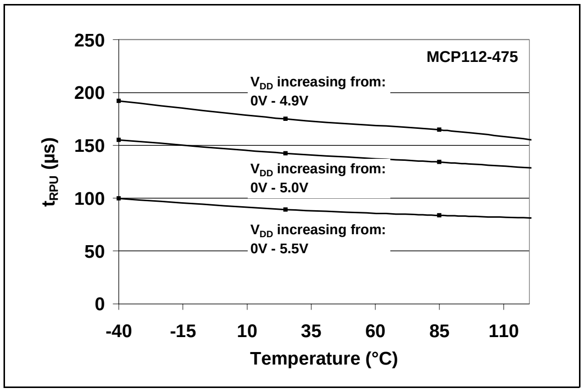



***FIGURE 2-24:*** *$t_{RPU}$ vs. Temperature (**MCP112-475**).*

**Note:** Unless otherwise indicated, all limits are specified for $V_{DD}$ = 1V to 5.5V, $R_{PU}$ = 100 kΩ (**only MCP111**; see **Figure 4-1**), $T_A$ = –40°C to +125°C.

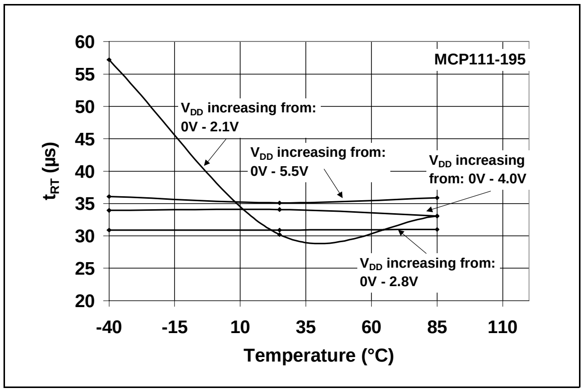



*FIGURE 2-25: $t_{RT}$ vs. Temperature (**MCP111-195**).*

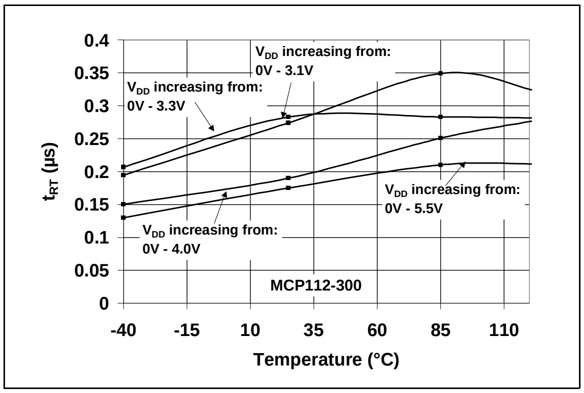



*FIGURE 2-26: $t_{RT}$ vs. Temperature (**MCP112-300**).*

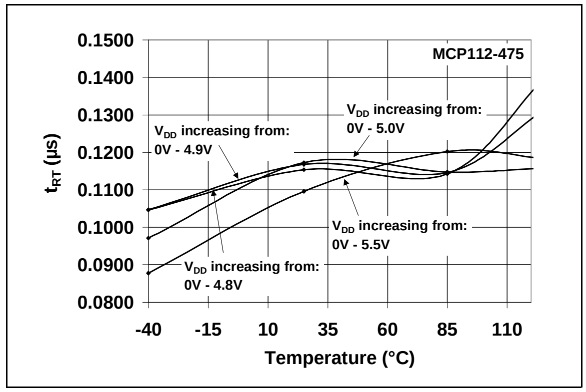



*FIGURE 2-27: $t_{RT}$ vs. Temperature (**MCP112-475**).*

## 3.0 PIN DESCRIPTION

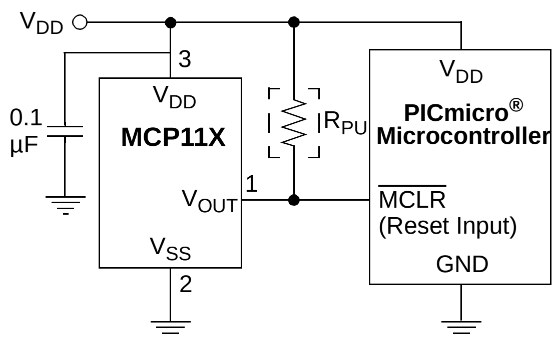
The descriptions of the pins are listed in Table 3-1.

**TABLE 3-1: PIN FUNCTION TABLE**

| Pin No. | | Symbol | Function |
|---|---|---|---|
| SOT23-3 SC-70 | T0-92 | | |
| 1 | 1 | $V_{OUT}$ | **Output State**<br>**$V_{DD}$ Falling:**<br>H = $V_{DD} > V_{TRIP}$<br>L = $V_{DD} < V_{TRIP}$<br><br>**$V_{DD}$ Rising:**<br>H = $V_{DD} > V_{TRIP} + V_{HYS}$<br>L = $V_{DD} < V_{TRIP} + V_{HYS}$ |
| 2 | 3 | $V_{SS}$ | Ground reference |
| 3 | 2 | $V_{DD}$ | Positive power supply |

## 4.0 APPLICATION INFORMATION

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. The second most common cause is when a slowly decaying power supply causes the microcontroller to begin executing instructions without sufficient voltage to sustain SRAM, thus producing indeterminate results. Figure 4-1 shows a typical application circuit.




**Note 1:** $R_{PU}$ may be required with the MCP111 due to the open-drain output. Resistor $R_{PU}$ is not required with the MCP112.

***FIGURE 4-1:*** *Typical Application Circuit.*

## 4.1 $V_{TRIP}$ Operation

The voltage trip point ($V_{TRIP}$) is determined on the falling edge of $V_{DD}$. The actual voltage trip point ($V_{TRIPAC}$) will be between the minimum trip point ($V_{TRIPMIN}$) and the maximum trip point ($V_{TRIPMAX}$). There is a hysteresis on this trip point to remove any "jitter" that would occur on the $V_{OUT}$ pin when the device $V_{DD}$ is at the trip point.

Figure 4-2 shows the state of the $V_{OUT}$ pin as determined by the $V_{DD}$ voltage. The $V_{TRIP}$ specification is for falling $V_{DD}$ voltages. When the $V_{DD}$ voltage is rising, the $V_{OUT}$ pin will not be driven high until $V_{DD}$ is at $V_{TRIP}$ + $V_{HYS}$.

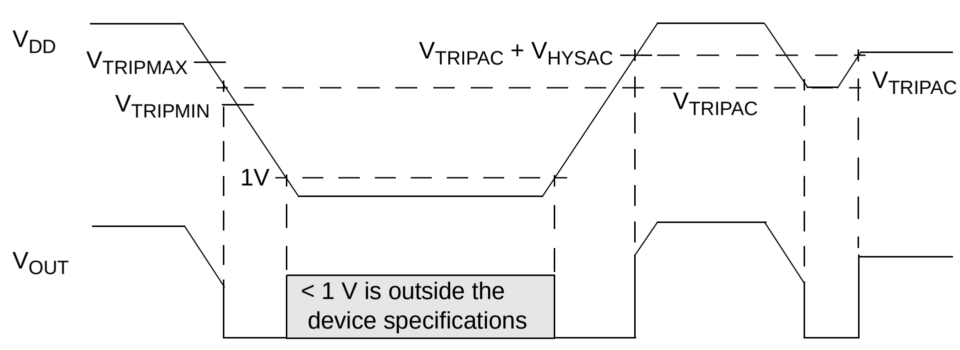



***FIGURE 4-2:*** *$V_{OUT}$ Operation as Determined by the $V_{TRIP}$ and $V_{HYS}$.*

## 4.2 Negative Going $V_{DD}$ Transients

The minimum pulse width (time) required to cause a reset may be an important criteria in the implementation of a POR circuit. This time is referred to as transient duration and is the amount of time needed for these supervisory devices to respond to a drop in $V_{DD}$. The transient duration time is dependant on the magnitude of $V_{TRIP} – V_{DD}$. Generally speaking, the transient duration decreases with increases in $V_{TRIP} – V_{DD}$.

Figure 4-3 shows a typical transient duration vs. reset comparator overdrive for which the MCP111/112 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. Figure 2-18 shows the transient response characteristics for the MCP111/112.

A 0.1 µF bypass cap mounted as close as possible to the $V_{DD}$ pin provides additional transient immunity (refer to Figure 4-1).

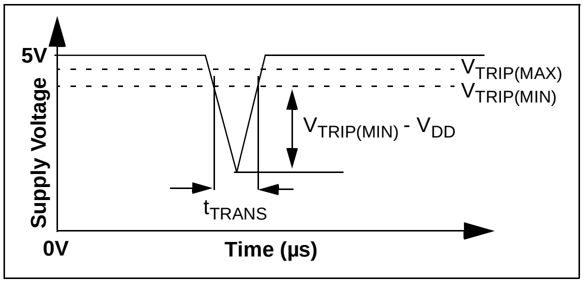



*FIGURE 4-3: Example of Typical Transient Duration Waveform.*

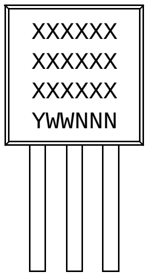
## 4.3 Effect of Temperature on Time-out Period ($t_{RPU}$)

The time-out period ($t_{RPU}$) determines how long the device remains in the reset condition. This is affected by both $V_{DD}$ and temperature. The graph shown in Figures 2-22, 2-23 and 2-24 show the typical response for different $V_{DD}$ values and temperatures.

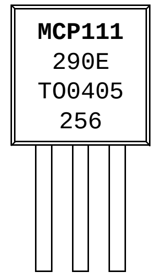
## 5.0 PACKAGING INFORMATION

### 5.1 Package Marking Information

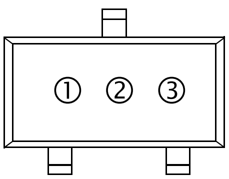
**3-Lead TO-92**




**Example:**




**3-Pin SC-70**

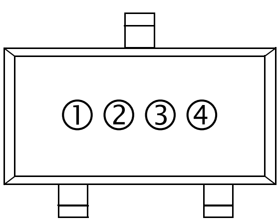



Top Side

**Example:**

| Part Number | SC-70 | Part Number | SC-70 |
|---|---|---|---|
| **MCP111T-195I/LB** | EPN | **MCP112T-195I/LB** | ERN |
| **MCP111T-240E/LB** | EQN | **MCP112T-240E/LB** | ESN |
| **MCP111T-270E/LB** | EGN | **MCP112T-270E/LB** | EAN |
| **MCP111T-290E/LB** | EHN | **MCP112T-290E/LB** | EBN |
| **MCP111T-300E/LB** | EJN | **MCP112T-300E/LB** | ECN |
| **MCP111T-315E/LB** | EKN | **MCP112T-315E/LB** | EDN |
| **MCP111T-450E/LB** | ELN | **MCP112T-450E/LB** | EEN |
| **MCP111T-475E/LB** | EMN | **MCP112T-475E/LB** | EFN |

**3-Pin SOT-23B**



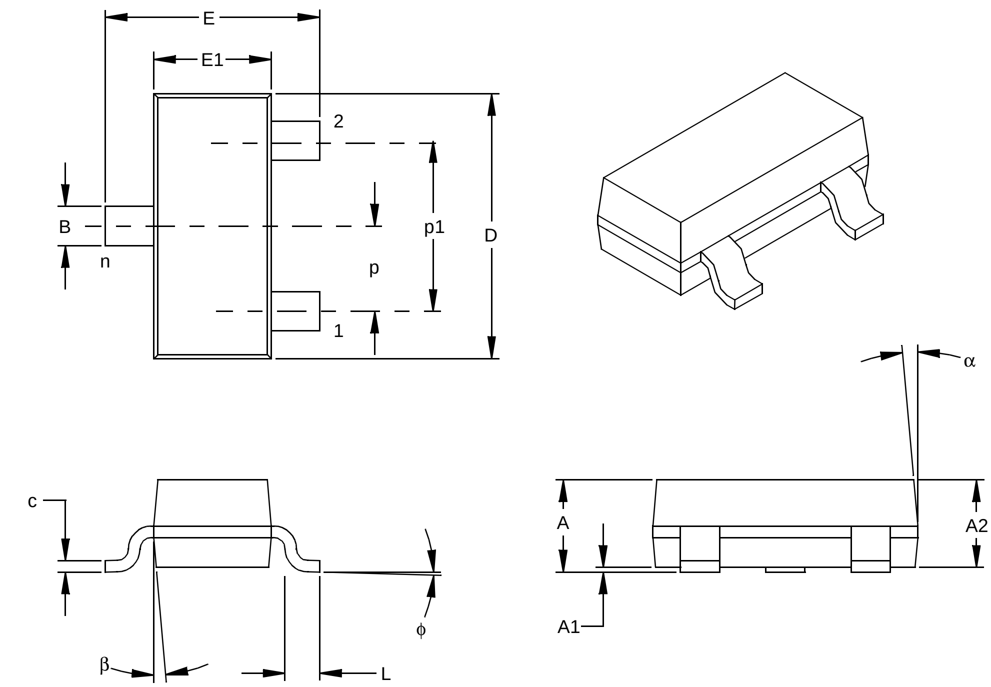

**Example:**

| Part Number | SOT-23 | Part Number | SOT-23 |
|---|---|---|---|
| **MCP111T-195I/TT** | MPNN | **MCP112T-195I/TT** | MRNN |
| **MCP111T-240ETT** | MQNN | **MCP112T-240ETT** | MSNN |
| **MCP111T-270E/TT** | MGNN | **MCP112T-270E/TT** | MANN |
| **MCP111T-290E/TT** | NHNN | **MCP112T-290E/TT** | MBNN |
| **MCP111T-300E/TT** | MJNN | **MCP112T-300E/TT** | MCNN |
| **MCP111T-315E/TT** | MKNN | **MCP112T-315E/TT** | MDNN |
| **MCP111T-450E/TT** | MLNN | **MCP112T-450E/TT** | MENN |
| **MCP111T-475E/TT** | MMNN | **MCP112T-475E/TT** | MFNN |

**Legend:**
1 Part Number + temperature range and voltage (two-digit code)
2 Part Number + temperature range and voltage (two-digit code)
3 Lot ID number
4 Year and work week

**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.

## 3-Lead Plastic Small Outline Transistor (TT) (SOT-23)

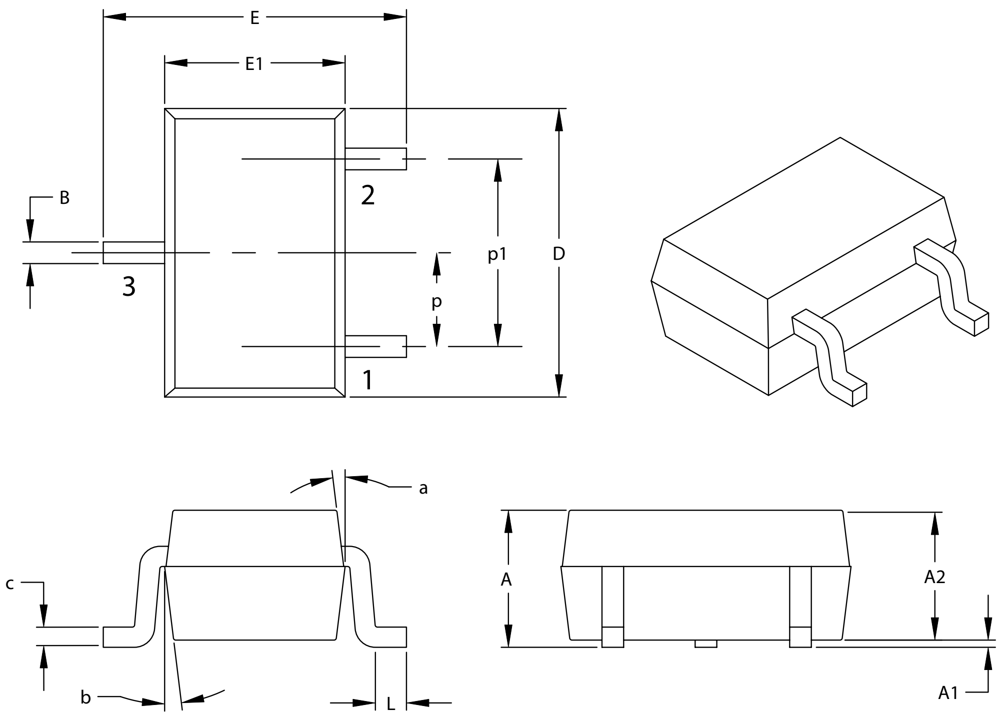



| Units | | INCHES* | | | MILLIMETERS | | |
|---|---|---|---|---|---|---|---|
| Dimension Limits | | MIN | NOM | MAX | MIN | NOM | MAX |
| Number of Pins | n | | 3 | | | 3 | |
| Pitch | p | | .038 | | | 0.96 | |
| Outside lead pitch (basic) | p1 | | .076 | | | 1.92 | |
| Overall Height | A | .035 | .040 | .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

## 3-Lead Plastic Small Outline Transistor (LB) (SC-70)




| Units | | INCHES | | MILLIMETERS* | |
|---|---|---|---|---|---|
| Dimension Limits | | MIN | MAX | MIN | MAX |
| Number of Pins | | 3 | | 3 | |
| Pitch | p | .026 BSC. | | 0.65 BSC. | |
| Outside lead pitch (basic) | p1 | .051 BSC. | | 1.30 BSC. | |
| Overall Height | A | .031 | .043 | 0.80 | 1.10 |
| Molded Package Thickness | A2 | .031 | .039 | 0.80 | 1.00 |
| Standoff | A1 | .000 | .0004 | 0.00 | .010 |
| Overall Width | E | .071 | .094 | 1.80 | 2.40 |
| Molded Package Width | E1 | .045 | .053 | 1.15 | 1.35 |
| Overall Length | D | .071 | .089 | 1.80 | 2.25 |
| Foot Length | L | .004 | .016 | 0.10 | 0.41 |
| Lead Thickness | c | .003 | .010 | 0.08 | 0.25 |
| Lead Width | B | .006 | .016 | 0.15 | 0.40 |
| Mold Draft Angle Top | a | 8° | 12° | 8° | 12° |
| Mold Draft Angle Bottom | b | 8° | 12° | 8° | 12° |

*Controlling Parameter

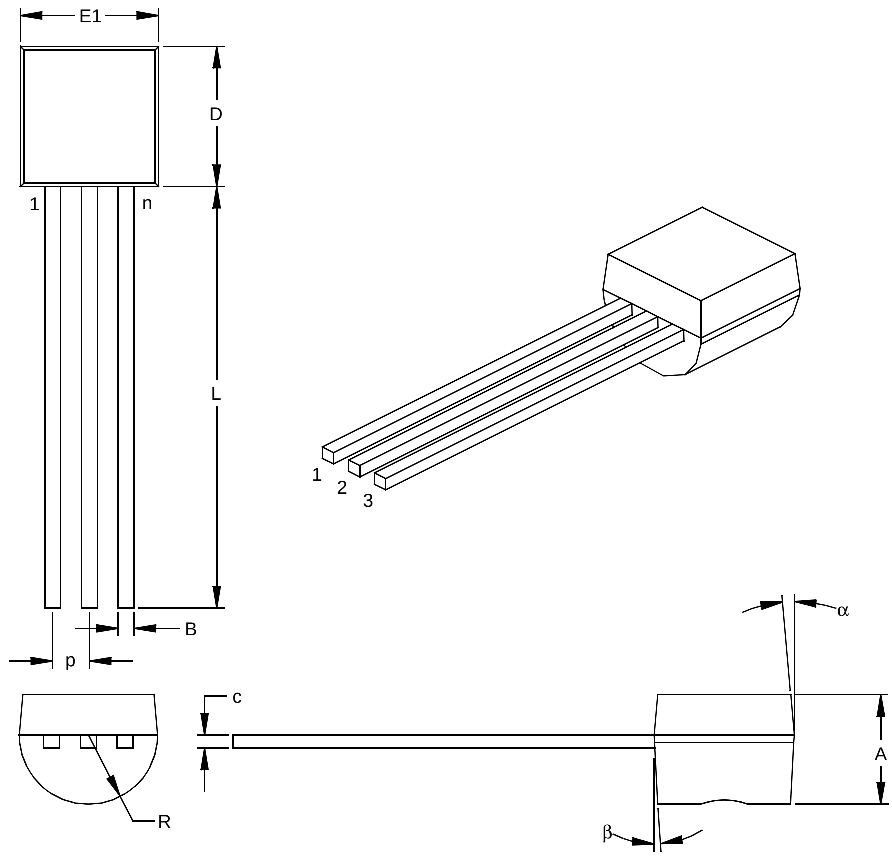
Notes:

Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .005" (0.127mm) per side.

JEITA (EIAJ) Equivalent: SC70

Drawing No. C04-104

## 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

## 5.2 Product Tape and Reel Specifications

**FIGURE 5-1: EMBOSSED CARRIER DIMENSIONS (8, 12, 16 AND 24 MM TAPE ONLY)**

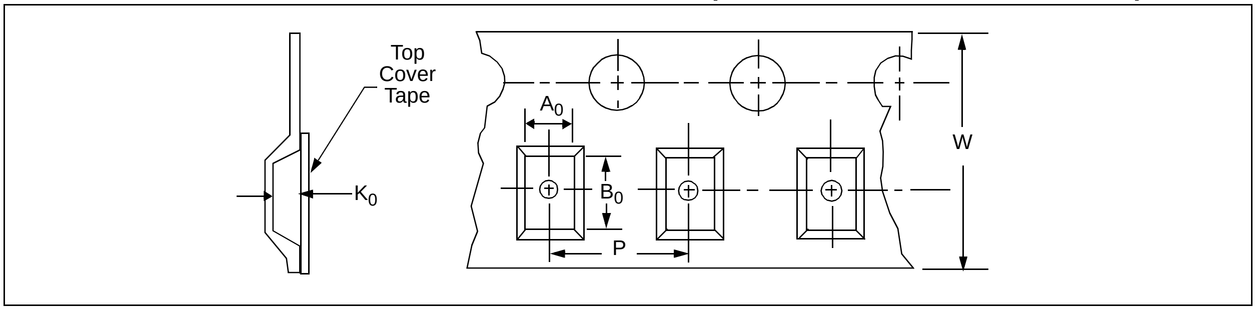



**TABLE 1: CARRIER TAPE/CAVITY DIMENSIONS**

| Case Outline | Package Type | | Carrier Dimensions | | Cavity Dimensions | | | Output Quantity Units | Reel Diameter in mm |
|---|---|---|---|---|---|---|---|---|---|
| | | | W mm | P mm | A0 mm | B0 mm | K0 mm | | |
| TT | SOT-23B | 3L | 8 | 4 | 3.15 | 2.77 | 1.22 | 3000 | 180 |
| LB | SC-70 | 3L | 8 | 4 | 2.4 | 2.4 | 1.19 | 3000 | 180 |

**FIGURE 5-2: 3-LEAD SOT-23/SC70 DEVICE TAPE AND REEL SPECIFICATIONS**

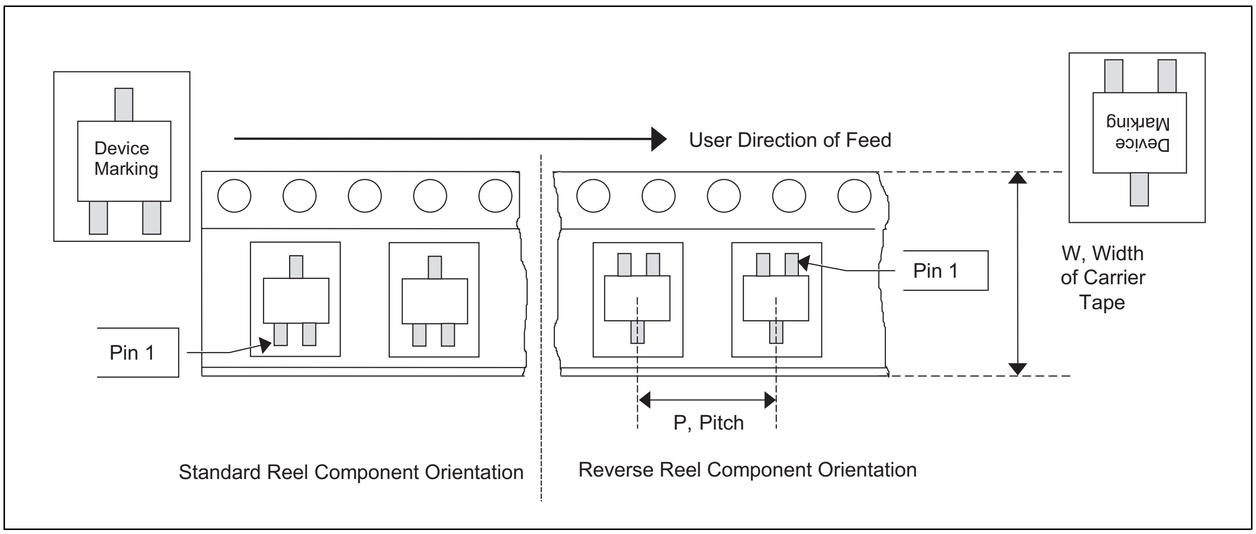
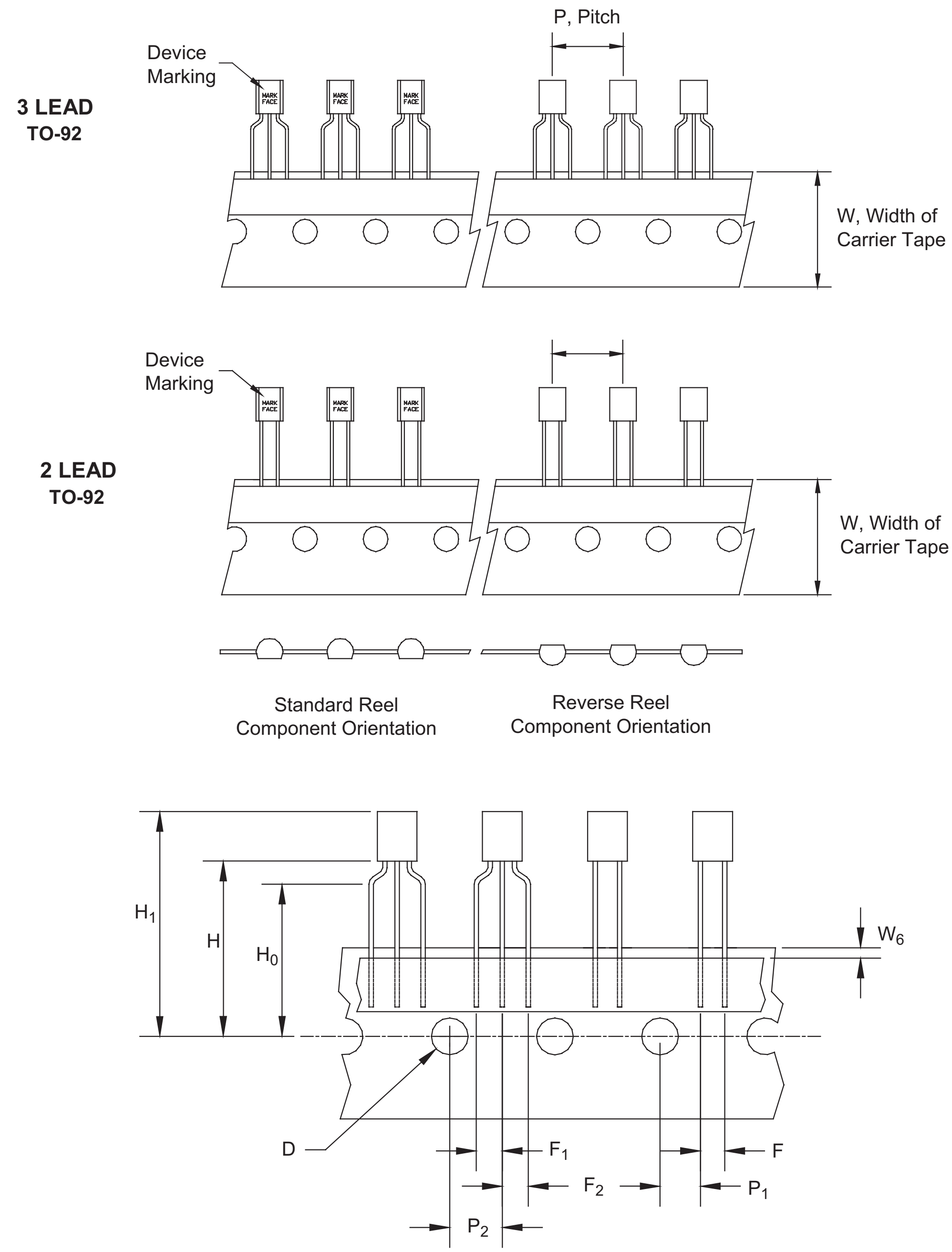


**FIGURE 5-3: TO-92 DEVICES**



## 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 | XXX | X | XX |
|---|---|---|---|---|
| Device | Tape/Reel Option | Monitoring Options | Temperature Range | Package |

| | |
|---|---|
| Device: | MCP111: MicroPower Voltage Detector, open-drain<br>MCP111T: MicroPower Voltage Detector, open-drain (Tape and Reel)<br>MCP112: MicroPower Voltage Detector, push-pull<br>MCP112T: MicroPower Voltage Detector, push-pull (Tape and Reel) |
| Monitoring Options: | 195 = 1.90V<br>240 = 2.32V<br>270 = 2.63V<br>290 = 2.90V<br>300 = 2.93V<br>315 = 3.08V<br>450 = 4.38V<br>475 = 4.63V |
| Temperature Range: | I = -40°C to +85°C (MCP11X-195 only)<br>E = -40°C to +125°C (Except MCP11X-195 only) |
| Package: | TT = SOT-23B, 3-lead<br>LB = SC-70, 3-lead<br>TO = TO-92, 3-lead |

**Examples:**

a) MCP111T-195I/TT: Tape and Reel, 1.95V option, open-drain, -40°C to +85°C, SOT-23B package.

b) MCP111T-315E/LB: Tape and Reel, 3.15V option, open-drain, -40°C to +125°C, SC-70-3 package.

c) MCP111-300E/TO: 3.00V option, open-drain, -40°C to +125°C, TO-92-3 package.

a) MCP112T-290E/TT: Tape and Reel, 2.90V option, push-pull, -40°C to +125°C, SOT-23B-3 package.

b) MCP112T-475E/LB: Tape and Reel, 4.75V option, push-pull, -40°C to +125°C, SC-70-3 package.

c) MCP112-450E/TO: 4.5V option, push-pull, -40°C to +125°C, TO-92-3 package.

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

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

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