MCP102/103/121/131

Micropower Voltage Supervisors

Features:

- Ultra-Low Supply Current: 1.75 µA (steady-state maximum)
- Precision Monitoring Options of:
  - 1.90V, 2.32V, 2.63V, 2.93V, 3.08V, 4.38V and 4.63V
- Resets Microcontroller in a Power-Loss Event
- $\overline{\text{RST}}$ Pin (active-low):
  - **MCP121:** Active-low, Open-drain
  - **MCP131:** Active-low, Open-drain with Internal Pull-up Resistor
  - **MCP102** and **MCP103:** Active-low, Push-pull
- Reset Delay Timer (120 ms delay, typical)
- Available in SOT-23, 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**)
- Pb-free Devices

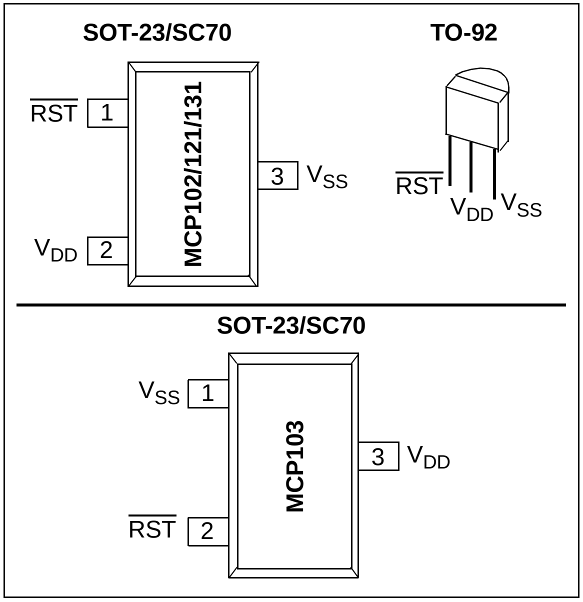
Applications:

- Critical Microcontroller and Microprocessor Power-monitoring Applications
- Computers
- Intelligent Instruments
- Portable Battery-powered Equipment

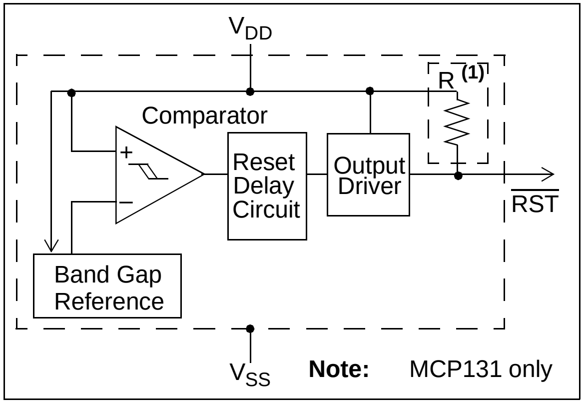
General Description:

The MCP102/103/121/131 devices are voltage supervisor devices designed to keep a microcontroller in reset until the system voltage has reached and stabilized at the proper level for reliable system operation. Table 1 shows the available features for these devices.

Package Types



Block Diagram



Note: MCP131 only

TABLE 1: DEVICE FEATURES

Device	Output		Reset Delay (typ)	Package Pinout (Pin # 1, 2, 3)	Comment
	Type	Pull-up Resistor			
MCP102	Push-pull	No	120 ms	$\overline{RST}$, V_{DD}, V_{SS}	
MCP103	Push-pull	No	120 ms	V_{SS}, $\overline{RST}$, V_{DD}	
MCP121	Open-drain	External	120 ms	$\overline{RST}$, V_{DD}, V_{SS}	
MCP131	Open-drain	Internal (~95 kΩ)	120 ms	$\overline{RST}$, V_{DD}, V_{SS}	
MCP111	Open-drain	External	No	V_{OUT}, V_{SS}, V_{DD}	See **MCP111/112** Data Sheet (DS21889)
MCP112	Push-Pull	No	No	V_{OUT}, V_{SS}, V_{DD}	See **MCP111/112** Data Sheet (DS21889)

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 (except $\overline{RST}$) w.r.t. V_{SS}	-0.6V to (V_{DD} + 1.0V)
$\overline{RST}$ output w.r.t. V_{SS}	-0.6V to 13.5V
Storage temperature	-65°C to + 150°C
Ambient temperature with power applied	-40°C to + 125°C
Maximum Junction temperature with power applied	150°C
ESD protection on all pins	³ 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 (**MCP121** only), 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 $\overline{RST}$ low		V_{DD}	1.0	—		V	$I_{\overline{RST}}$ = 10 µA, $V_{\overline{RST}}$ < 0.2V
Operating Current	**MCP102, MCP103, MCP121**	I_{DD}	—	< 1	1.75	µA	Reset Power-up Timer (t_{RPU}) Inactive
			—	—	20.0	µA	Reset Power-up Timer (t_{RPU}) Active
	MCP131	I_{DD}	—	< 1	1.75	µA	V_{DD} > V_{TRIP} and Reset Power-up Timer (t_{RPU}) Inactive
			—	—	75	µA	V_{DD} < V_{TRIP} and Reset Power-up Timer (t_{RPU}) Inactive **(Note 3)**
			—	—	90	µA	Reset Power-up Timer (t_{RPU}) Active **(Note 4)**

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

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

3: $\overline{RST}$ output is forced low. There is a current through the internal pull-up resistor.

4: This includes the current through the internal pull-up resistor and the reset power-up timer.

5: This specification allows this device to be used in PIC® microcontroller applications that require In-Circuit Serial Programming™ (ICSP™) (see device-specific programming specifications for voltage requirements). This specification DOES NOT allow a continuous high voltage to be present on the open-drain output pin (V_{OUT}). The total time that the V_{OUT} pin can be above the maximum device operational voltage (5.5V) is 100s. Current into the V_{OUT} pin should be limited to 2 mA and it is recommended that the device operational temperature be maintained between 0°C to 70°C (+25°C preferred). For additional information, please refer to Figure 2-33.

6: This parameter is established by characterization and not 100% tested.

DC CHARACTERISTICS (CONTINUED)

Electrical Specifications: Unless otherwise indicated, all limits are specified for: V_{DD} = 1V to 5.5V, R_{PU} = 100 kΩ (**MCP121** only), T_A = -40°C to +125°C.

Parameters		Sym.	Min.	Typ.	Max.	Units	Conditions
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-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-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	
$\overline{\text{RST}}$ Low-level Output Voltage		V_{OL}	—	—	0.4	V	I_{OL} = 500 µA, $V_{DD} = V_{TRIP(MIN)}$
$\overline{\text{RST}}$ High-level Output Voltage **(MCP102 and MCP103 only)**		V_{OH}	V_{DD} – 0.6	—	—	V	I_{OH} = 1 mA; for **MCP102/MCP103** only (push-pull output)
Internal Pull-up Resistor **(MCP131 only)**		R_{PU}	—	95	—	kΩ	V_{DD} = 5.5V
Open-drain High Voltage on Output **(MCP121 only)**		V_{ODH}	—	—	13.5 **(5)**	V	V_{DD} = 3.0V, Time voltage > 5.5V applied ≤ 100s, current into pin limited to 2 mA, 25°C operation recommended (**Note 5**, **Note 6**)
Open-drain Output Leakage Current **(MCP121 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.

3: $\overline{\text{RST}}$ output is forced low. There is a current through the internal pull-up resistor.

4: This includes the current through the internal pull-up resistor and the reset power-up timer.

5: This specification allows this device to be used in PIC® microcontroller applications that require In-Circuit Serial Programming™ (ICSP™) (see device-specific programming specifications for voltage requirements). This specification DOES NOT allow a continuous high voltage to be present on the open-drain output pin (V_{OUT}). The total time that the V_{OUT} pin can be above the maximum device operational voltage (5.5V) is 100s. Current into the V_{OUT} pin should be limited to 2 mA and it is recommended that the device operational temperature be maintained between 0°C to 70°C (+25°C preferred). For additional information, please refer to Figure 2-33.

6: This parameter is established by characterization and not 100% tested.

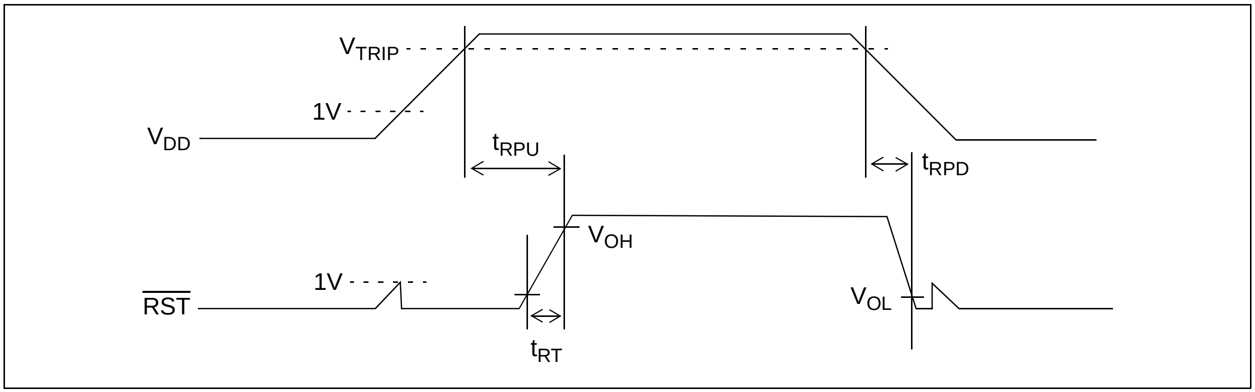


FIGURE 1-1: *Timing Diagram.*

AC CHARACTERISTICS

Electrical Specifications: Unless otherwise indicated, all limits are specified for: V_{DD} = 1V to 5.5V, R_{PU} = 100 kΩ (**MCP121** only), T_A = -40°C to +125°C.

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
V_{DD} Detect to $\overline{RST}$ Inactive	t_{RPU}	80	120	180	ms	Figure 1-1 and C_L = 50 pF
V_{DD} Detect to $\overline{RST}$ 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)
$\overline{RST}$ Rise Time After $\overline{RST}$ Active **(MCP102 and MCP103 only)**	t_{RT}	—	5	—	µs	For $\overline{RST}$ 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 (**MCP121** only), T_A = -40°C to +125°C.

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Temperature Ranges						
Specified Temperature Range	T_A	-40	—	+85	ºC	**MCP1XX-195**
Specified Temperature Range	T_A	-40	—	+125	ºC	**Except MCP1XX-195**
Maximum Junction Temperature	T_J	—	—	+150	ºC	
Storage Temperature Range	T_A	-65	—	+150	ºC	
Package Thermal Resistances						
Thermal Resistance, 3L-SOT-23	θ_{JA}	—	308	—	ºC/W	
Thermal Resistance, 3L-SC70	θ_{JA}	—	335	—	ºC/W	
Thermal Resistance, 3L-TO-92	θ_{JA}	—	146	—	ºC/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 (**MCP121** only; see Figure 4-1), T_A = -40°C to +125°C.

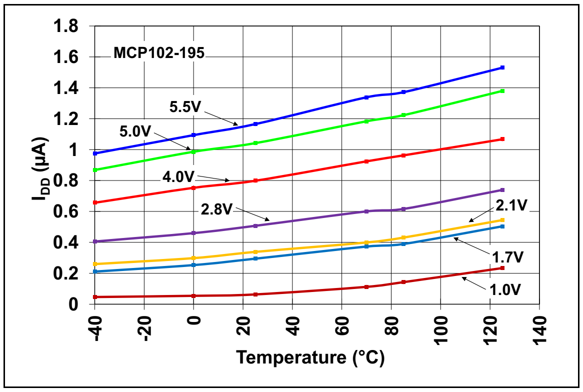


FIGURE 2-1: *I_{DD} vs. Temperature (Reset Power-up Timer Inactive)* ***(MCP102-195)****.*

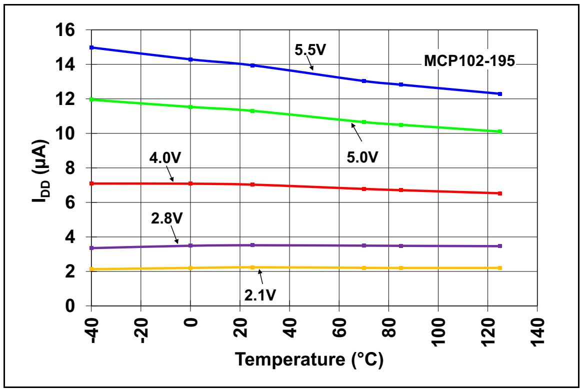


FIGURE 2-4: *I_{DD} vs. Temperature (Reset Power-up Timer Active)* ***(MCP102-195)****.*

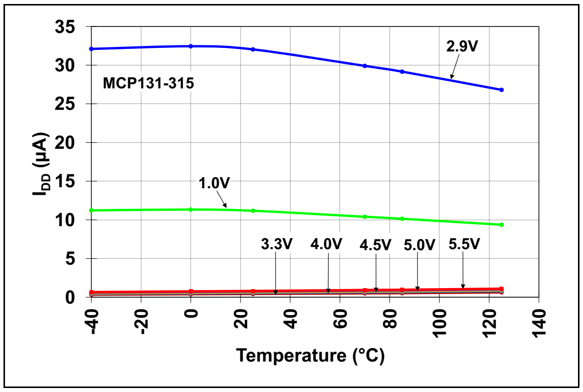


FIGURE 2-2: *I_{DD} vs. Temperature (Reset Power-up Timer Inactive)* ***(MCP131-315)****.*

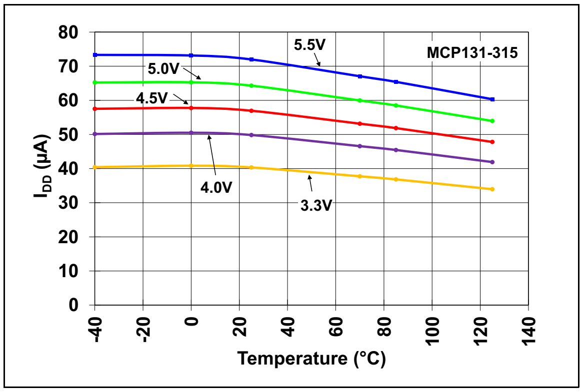


FIGURE 2-5: *I_{DD} vs. Temperature (Reset Power-up Timer Active)* ***(MCP131-315)****.*

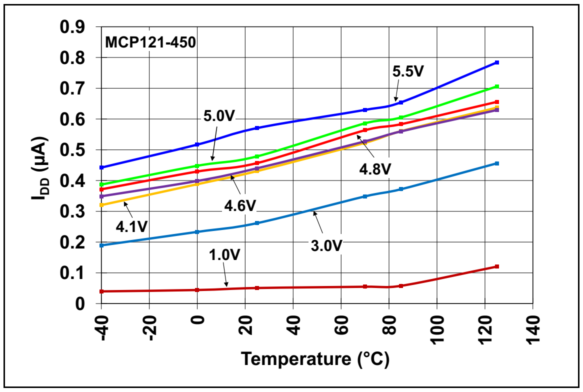


FIGURE 2-3: *I_{DD} vs. Temperature (Reset Power-up Timer Inactive)* ***(MCP121-450)****.*

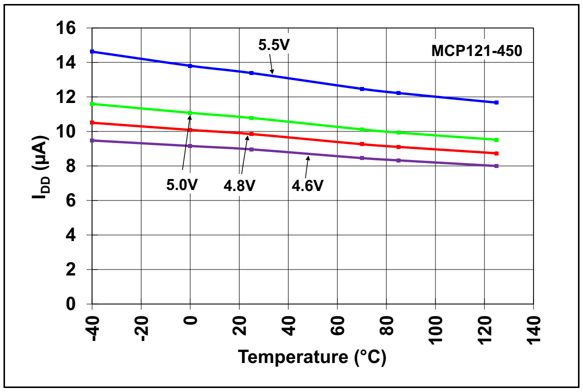


FIGURE 2-6: *I_{DD} vs. Temperature (Reset Power-up Timer Active)* ***(MCP121-450)****.*

Note: Unless otherwise indicated, all limits are specified for: V_{DD} = 1V to 5.5V, R_{PU} = 100 kΩ (**MCP121** only; see Figure 4-1), T_A = -40°C to +125°C.

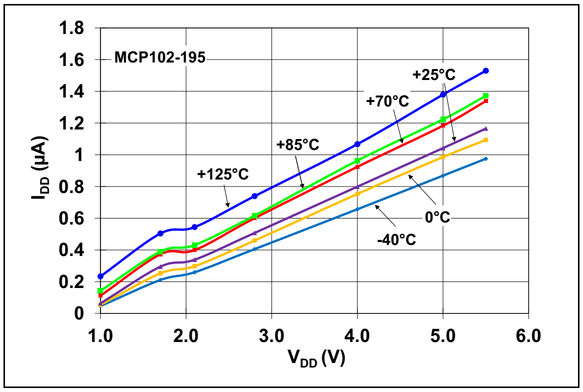


FIGURE 2-7: *I_{DD} vs. V_{DD} (Reset Power-up Timer Inactive) (**MCP102-195**).*

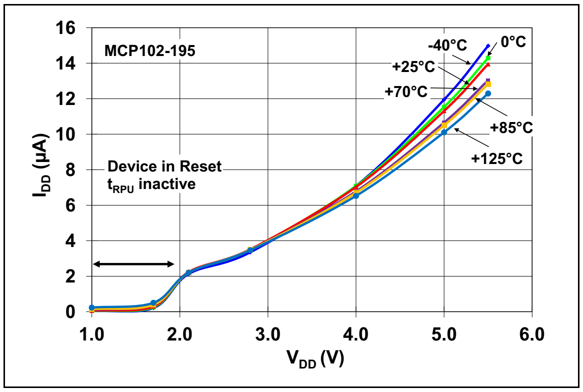


FIGURE 2-10: *I_{DD} vs.V_{DD} (Reset Power-up Timer Active) (**MCP102-195**).*

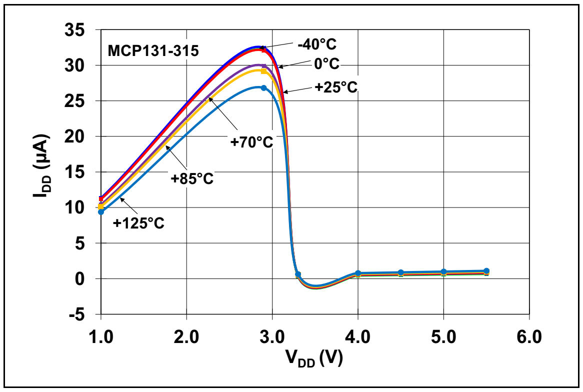


FIGURE 2-8: *I_{DD} vs. V_{DD} (Reset Power-up Timer Inactive) (**MCP131-315**).*

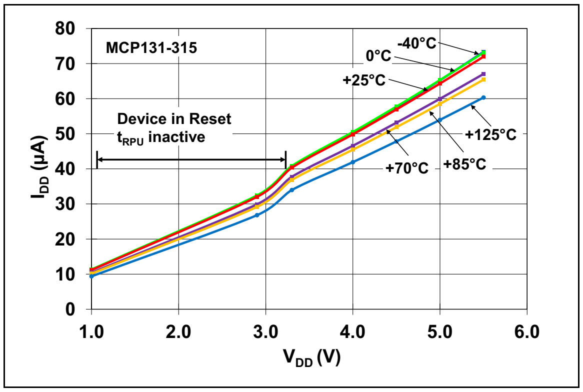


FIGURE 2-11: *I_{DD} vs.V_{DD} (Reset Power-up Timer Active) (**MCP131-315**).*

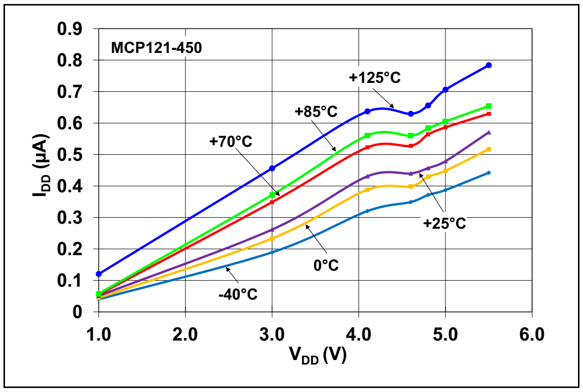


FIGURE 2-9: *I_{DD} vs. V_{DD} (Reset Power-up Timer Inactive) (**MCP121-450**).*

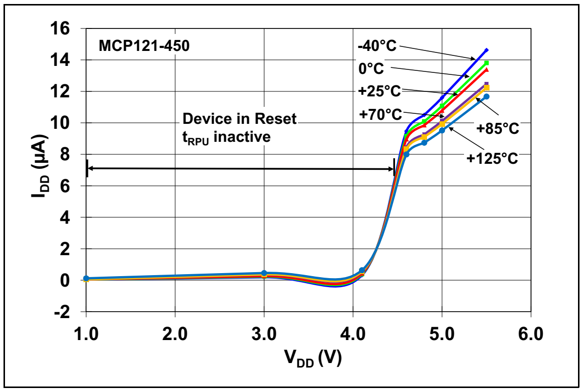


FIGURE 2-12: *I_{DD} vs.V_{DD} (Reset Power-up Timer Active) (**MCP121-450**).*

Note: Unless otherwise indicated, all limits are specified for: V_{DD} = 1V to 5.5V, R_{PU} = 100 kΩ (**MCP121**; see Figure 4-1), T_A = -40°C to +125°C.

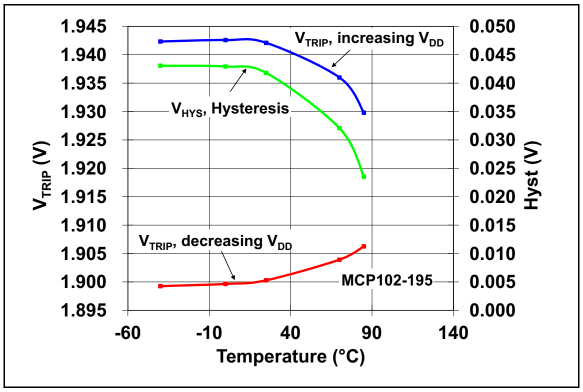


*FIGURE 2-13: V_{TRIP} vs. Temperature vs. Hysteresis (**MCP102-195**).*

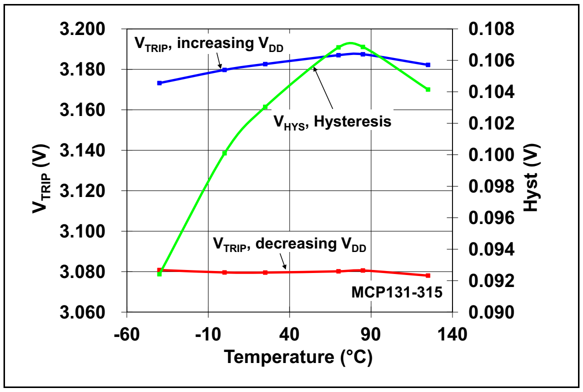


*FIGURE 2-14: V_{TRIP} vs. Temperature vs. Hysteresis (**MCP131-315**).*

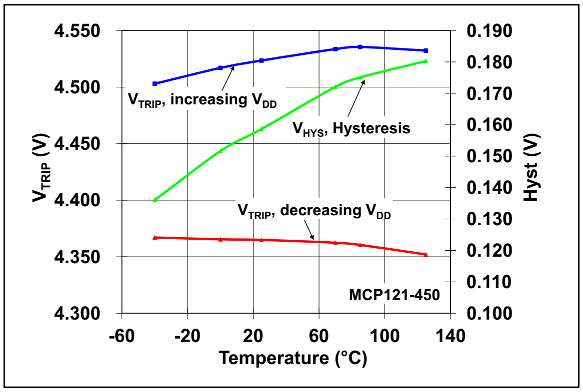


*FIGURE 2-15: V_{TRIP} vs. Temperature vs. Hysteresis (**MCP121-450**).*

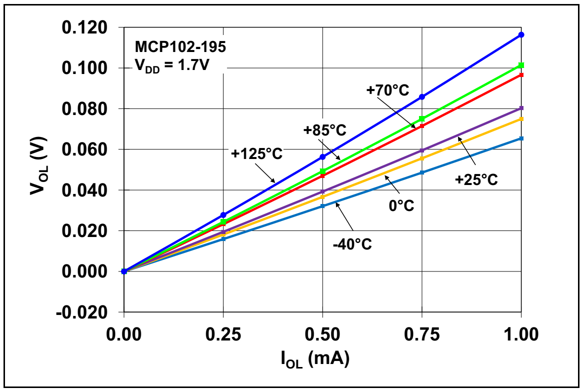


*FIGURE 2-16: V_{OL} vs. I_{OL} (**MCP102-195** @ V_{DD} = 1.7V).*

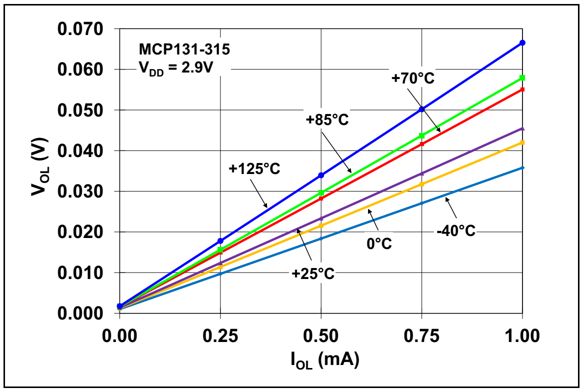


*FIGURE 2-17: V_{OL} vs. I_{OL} (**MCP131-315** @ V_{DD} = 2.9V).*

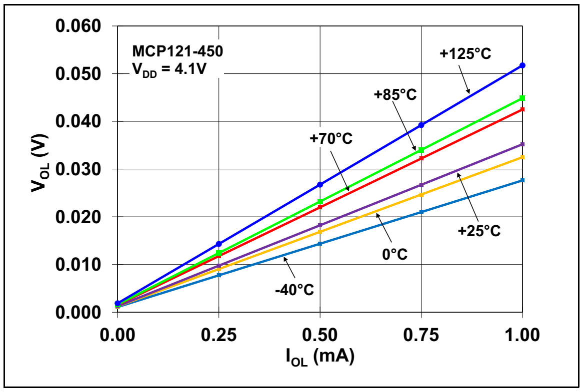


*FIGURE 2-18: V_{OL} vs. I_{OL} (**MCP121-450** @ V_{DD} = 4.1V).*

Note: Unless otherwise indicated, all limits are specified for: V_{DD} = 1V to 5.5V, R_{PU} = 100 kΩ (**MCP121** only; see Figure 4-1), T_A = -40°C to +125°C.

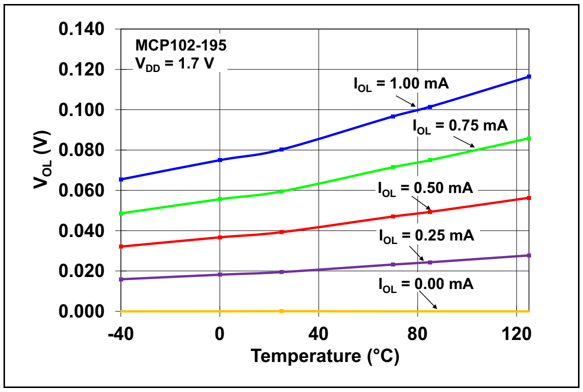


FIGURE 2-19: *V_{OL} vs. Temperature (**MCP102-195** @ V_{DD} = 1.7V).*

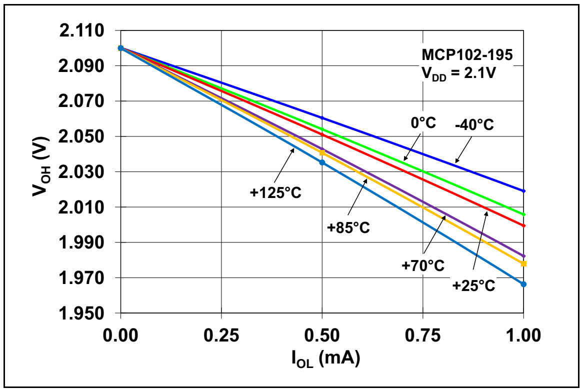


FIGURE 2-22: *V_{OH} vs. I_{OL} (**MCP102-195** @ V_{DD} = 2.1V).*

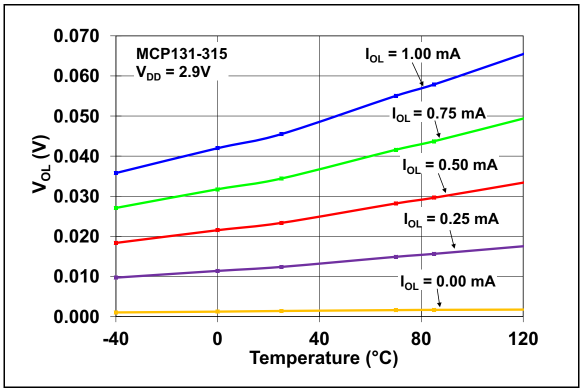


FIGURE 2-20: *V_{OL} vs. Temperature (**MCP131-315** @ V_{DD} = 2.9V).*

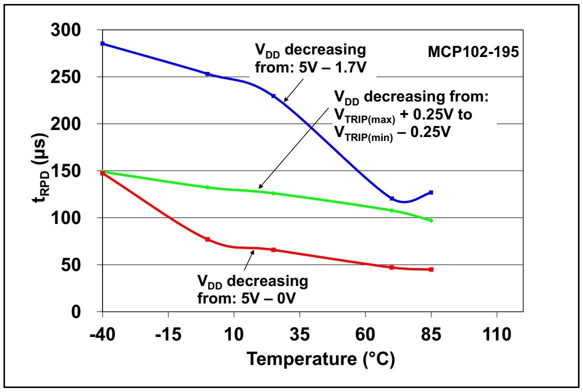


FIGURE 2-23: *t_{RPD} vs. Temperature (**MCP102-195**).*

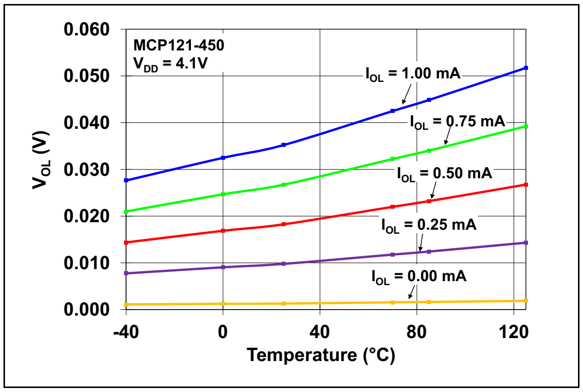


FIGURE 2-21: *V_{OL} vs. Temperature (**MCP121-450** @ V_{DD} = 4.1V).*

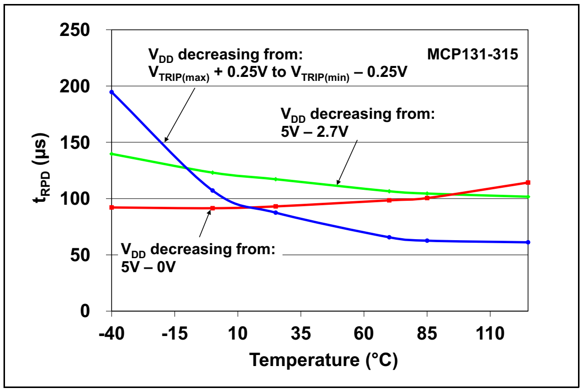


FIGURE 2-24: *t_{RPD} vs. Temperature (**MCP131-315**).*

Note: Unless otherwise indicated, all limits are specified for: V_{DD} = 1V to 5.5V, R_{PU} = 100 kΩ (**MCP121** only; see Figure 4-1), T_A = -40°C to +125°C.

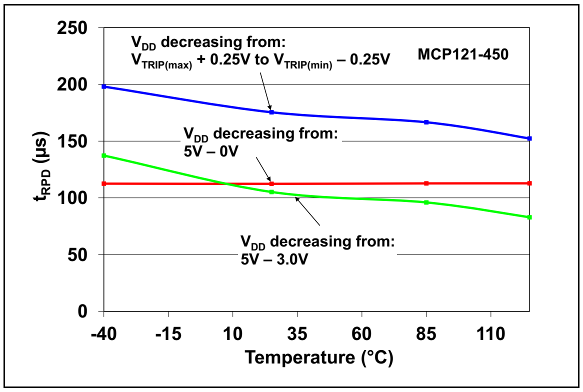


FIGURE 2-25: *t_{RPD} vs. Temperature (MCP121-450).*

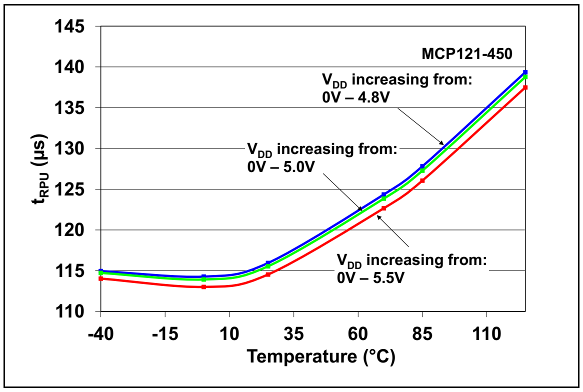


FIGURE 2-28: *t_{RPU} vs. Temperature (MCP121-450).*

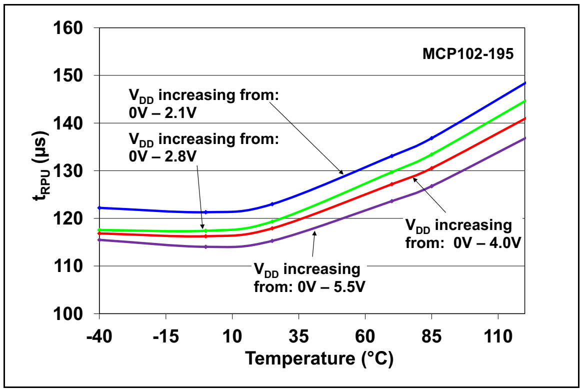


FIGURE 2-26: *t_{RPU} vs. Temperature (MCP102-195).*

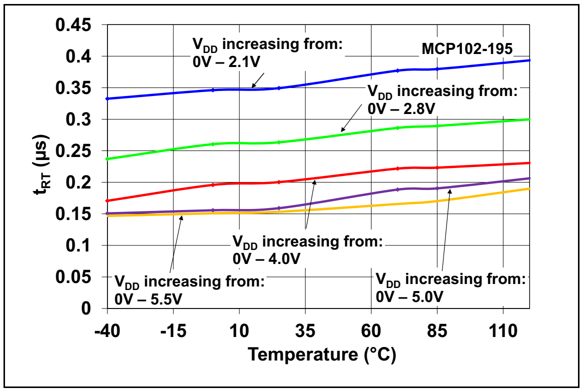


FIGURE 2-29: *t_{RT} vs. Temperature (MCP102-195).*

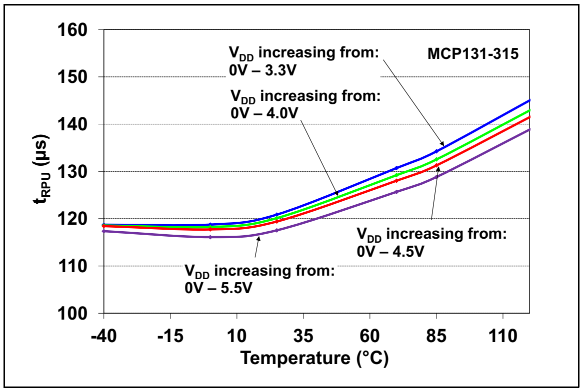


FIGURE 2-27: *t_{RPU} vs. Temperature (MCP131-315).*

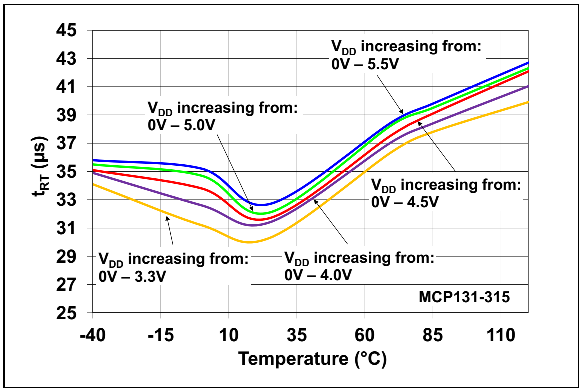


FIGURE 2-30: *t_{RT} vs. Temperature (MCP131-315).*

Note: Unless otherwise indicated, all limits are specified for: V_{DD} = 1V to 5.5V, R_{PU} = 100 kΩ (**MCP121** only; see Figure 4-1), T_A = -40°C to +125°C.

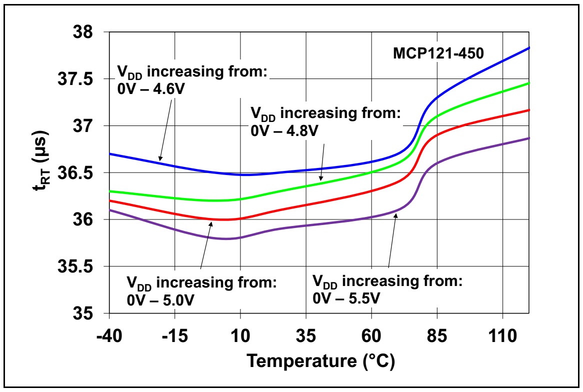


FIGURE 2-31: *t_{RT} vs. Temperature (**MCP121-450**).*

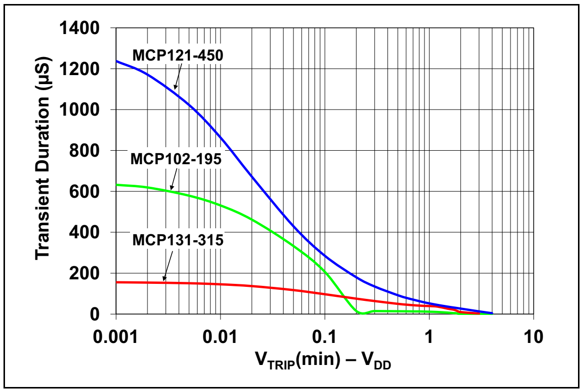


FIGURE 2-32: *Transient Duration vs. V_{TRIP}(min) – V_{DD}.*

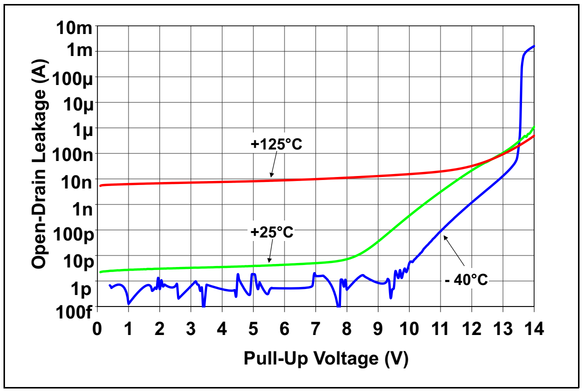


FIGURE 2-33: *Open-Drain Leakage Current vs. Voltage Applied to V_{OUT} Pin (**MCP121-195**).*

3.0 PIN DESCRIPTION

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

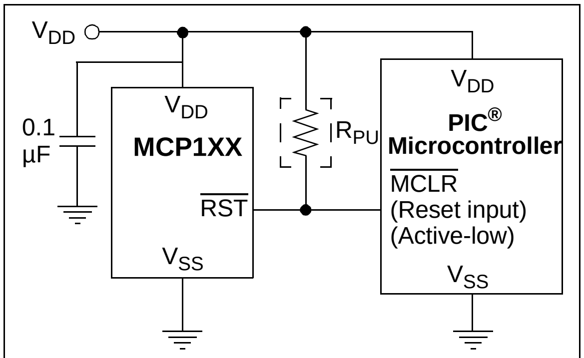
TABLE 3-1: PIN FUNCTION TABLE

Pin No.		Symbol	Function
MCP102 MCP121 MCP131	**MCP103**		
1	2	$\overline{RST}$	Output State V_{DD} Falling: H = $V_{DD} > V_{TRIP}$ L = $V_{DD} < V_{TRIP}$ V_{DD} Rising: H = $V_{DD} > V_{TRIP} + V_{HYS}$ L = $V_{DD} < V_{TRIP} + V_{HYS}$
2	3	V_{DD}	Positive power supply
3	1	V_{SS}	Ground reference

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 volatile memory (RAM), thus producing indeterminate results. Figure 4-1 shows a typical application circuit.

MCP102/103/121/131 are voltage supervisor devices designed to keep a microcontroller in reset until the system voltage has reached and stabilized at the proper level for reliable system operation. These devices also operate as protection from brown-out conditions.



Note 1: Resistor R_{PU} may be required with the MCP121 due to the open-drain output. Resistor R_{PU} may not be required with the MCP131 due to the internal pull-up resistor. The MCP102 and MCP103 do not require the external pull-up resistor.

FIGURE 4-1: *Typical Application Circuit.*

4.1 $\overline{\text{RST}}$ Operation

The $\overline{\text{RST}}$ output pin operation determines how the device can be used and indicates when the system should be forced into reset. To accomplish this, an internal voltage reference is used to set the voltage trip point (V_{TRIP}). Additionally, there is a hysteresis on this trip point.

When the falling edge of V_{DD} crosses this voltage threshold, the reset power-down timer (t_{RPD}) starts. When this delay timer times out, the $\overline{\text{RST}}$ pin is forced low.

When the rising edge of V_{DD} crosses this voltage threshold, the reset power-up timer (t_{RPU}) starts. When this delay timer times out, the $\overline{\text{RST}}$ pin is forced high, t_{RPU} is active and there is additional system current.

The actual voltage trip point (V_{TRIPAC}) will be between the minimum trip point ($V_{TRIPMIN}$) and the maximum trip point ($V_{TRIPMAX}$). The hysteresis on this trip point and the delay timer (t_{RPU}) are to remove any "jitter" that would occur on the $\overline{\text{RST}}$ pin when the device V_{DD} is at the trip point.

Figure 4-2 shows the waveform of the $\overline{\text{RST}}$ pin as determined by the V_{DD} voltage, while Table 4-1 shows the state of the $\overline{\text{RST}}$ pin. The V_{TRIP} specification is for falling V_{DD} voltages. When the V_{DD} voltage is rising, the $\overline{\text{RST}}$ will not be driven high until V_{DD} is at $V_{TRIP} + V_{HYS}$. Once V_{DD} has crossed the voltage trip point, there is also a minimal delay time (t_{RPD}) before the $\overline{\text{RST}}$ pin is driven low.

TABLE 4-1: $\overline{\text{RST}}$ PIN STATES

Device	State of $\overline{\text{RST}}$ Pin when:		Output Driver
	$V_{DD} < V_{TRIP}$	$V_{DD} > V_{TRIP} + V_{HYS}$	
MCP102	L	H	Push-pull
MCP103	L	H	Push-pull
MCP121	L	H (1)	Open-drain (1)
MCP131	L	H (2)	Open-drain (2)

Note 1: Requires external pull-up resistor
2: Has internal pull-up resistor

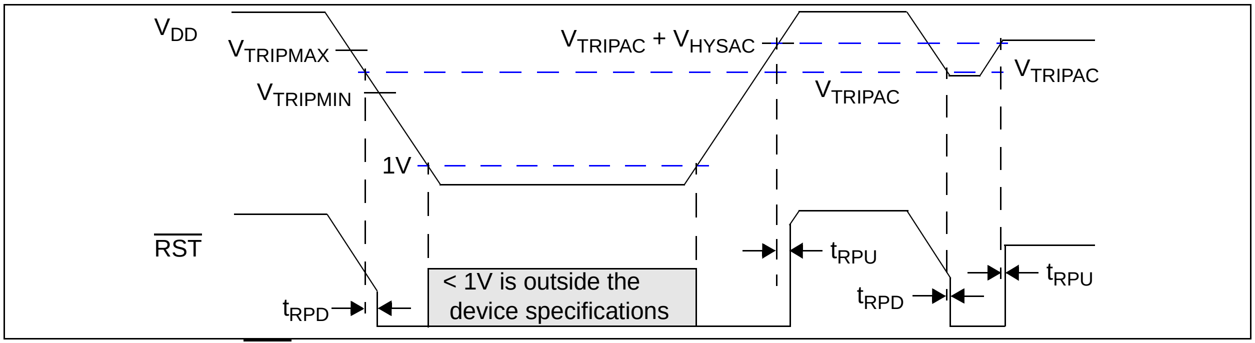


FIGURE 4-2: *$\overline{\text{RST}}$ Operation as Determined by the V_{TRIP} and V_{HYS}.*

4.2 Negative Going V_{DD} Transients

The minimum pulse width (time) required to cause a reset may be an important criterion in the implementation of a Power-on Reset (POR) circuit. This time is referred to as transient duration, defined as the amount of time needed for these supervisory devices to respond to a drop in V_{DD}. The transient duration time is dependent 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 versus reset comparator overdrive, for which the MCP102/103/121/131 will not generate a reset pulse. It shows that the farther below the trip point of the transient pulse goes, the shorter the duration of the pulse required to cause a reset gets. Figure 2-32 shows the transient response characteristics for the MCP102/103/121/131.

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

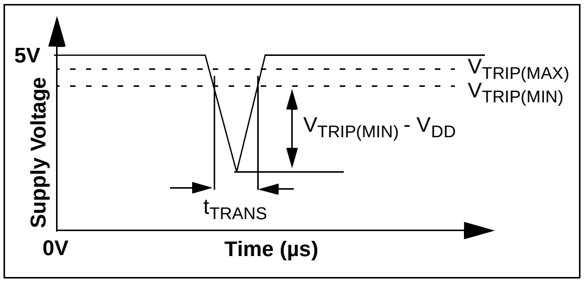


FIGURE 4-3: Example of Typical Transient Duration Waveform.

4.3 Reset Power-up Timer (t_{RPU})

Figure 4-4 illustrates the device’s current states. While the system is powering down, the device has a low current. This current is dependent on the device V_{DD} and trip point. When the device V_{DD} rises through the voltage trip point (V_{TRIP}), an internal timer starts. This timer consumes additional current until the $\overline{\text{RST}}$ pin is driven (or released) high. This time is known as the Reset Power-up Time (t_{RPU}). Figure 4-4 shows when t_{RPU} is active (device consuming additional current).

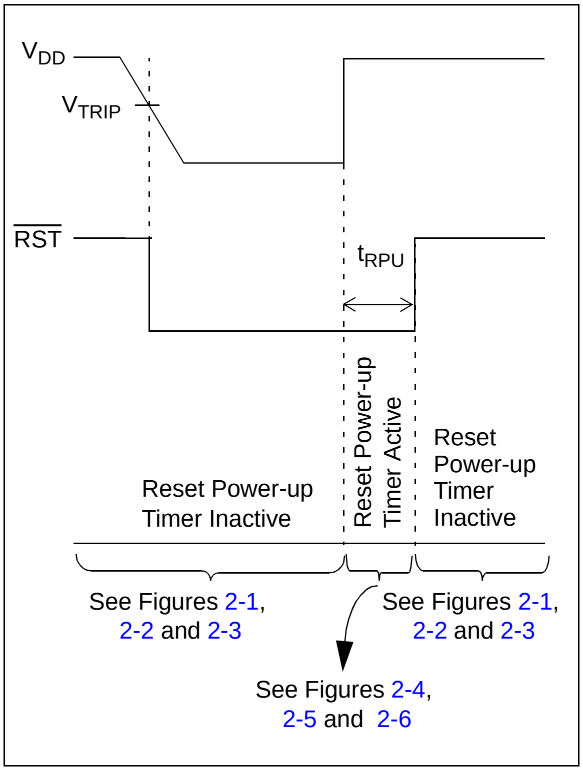


FIGURE 4-4: Reset Power-up Timer Waveform.

4.3.1 EFFECT OF TEMPERATURE ON RESET POWER-UP TIMER (T_{RPU})

The Reset Power-up timer time-out period (t_{RPU}) determines how long the device remains in the reset condition. This is affected by both V_{DD} and temperature. Typical responses for different V_{DD} values and temperatures are shown in Figures 2-26, 2-27 and 2-28.

4.4 Usage in PIC® Microcontroller, ICSP™ Applications (MCP121 only)

Figure 4-5 shows the typical application circuit for using the MCP121 for voltage supervision function when the PIC microcontroller will be programmed via the ICSP feature. Additional information is available in TB087, *“Using Voltage Supervisors with PIC® Microcontroller Systems which Implement In-Circuit Serial Programming™”*, DS91087.

Note:	It is recommended that the current into the $\overline{\text{RST}}$ pin be current limited by a 1 kΩ resistor.

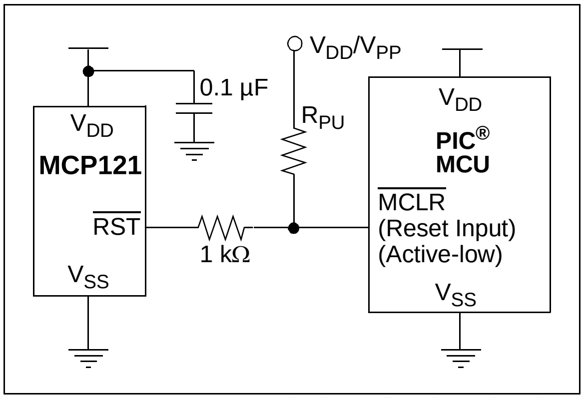
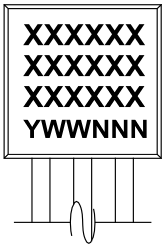


FIGURE 4-5: *Typical Application Circuit for PIC® Microcontroller with the ICSP™ Feature.*

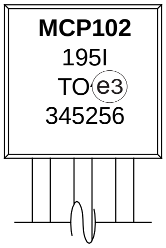
5.0 PACKAGING INFORMATION

5.1 Package Marking Information

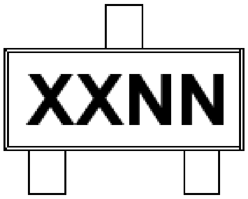
3-Lead TO-92



Example



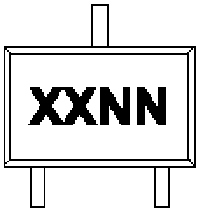
3-Lead SOT-23



Example

Part Number	MCP1xx =			
	MCP102	MCP103	MCP121	MCP131
MCP1xxT-195I/TT	JGNN	TGNN	LGNN	KGNN
MCP1xxT-240ETT	JHNN	THNN	LHNN	KHNN
MCP1xxT-270E/TT	JJNN	TJNN	LJNN	KJNN
MCP1xxT-300E/TT	JKNN	TKNN	LKNN	KKNN
MCP1xxT-315E/TT	JLNN	TLNN	LLNN	KLNN
MCP1xxT-450E/TT	JMNN	TMNN	LMNN	KMNN
MCP1xxT-475E/TT	JPNN	TPNN	LPNN	KPNN

3-Lead SC70



Example

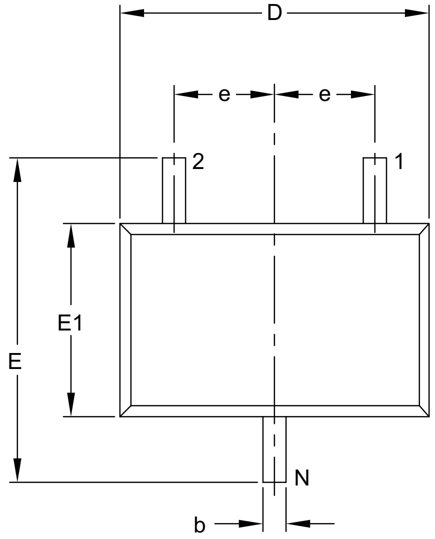
Part Number	MCP1xx =			
	MCP102	MCP103	MCP121	MCP131
MCP1xxT-195I/LB	BGNN	FGNN	DGNN	CGNN
MCP1xxT-240E/LB	BHNN	FHNN	DHNN	CHNN
MCP1xxT-270E/LB	BJNN	FJNN	DJNN	CJNN
MCP1xxT-300E/LB	BKNN	FKNN	DKNN	CKNN
MCP1xxT-315E/LB	BLNN	FLNN	DLNN	CLNN
MCP1xxT-450E/LB	BMNN	FMNN	DMNN	CMNN
MCP1xxT-475E/LB	BPNN	FPNN	DPNN	CPNN

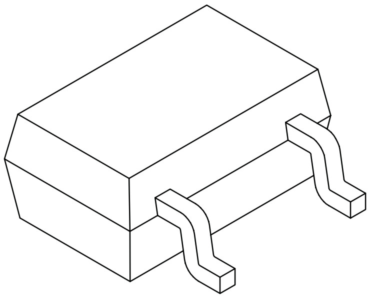
Legend:		
	XX...X	Customer-specific information
	Y	Year code (last digit of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code
	ⓔ3	Pb-free JEDEC designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator (ⓔ3) can be found on the outer packaging for this package.

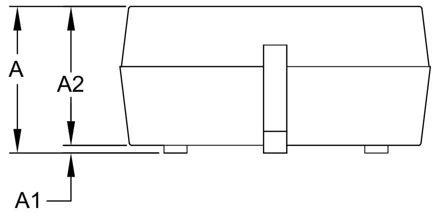
Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information.

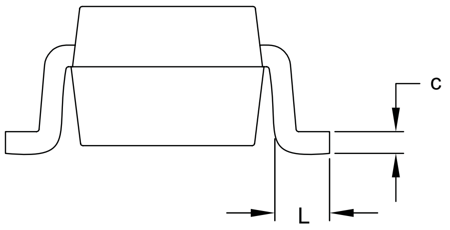
3-Lead Plastic Small Outline Transistor (LB) [SC70]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging









Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N	3		
Pitch	e	0.65 BSC		
Overall Height	A	0.80	–	1.10
Molded Package Thickness	A2	0.80	–	1.00
Standoff	A1	0.00	–	0.10
Overall Width	E	1.80	2.10	2.40
Molded Package Width	E1	1.15	1.25	1.35
Overall Length	D	1.80	2.00	2.25
Foot Length	L	0.10	0.20	0.46
Lead Thickness	c	0.08	–	0.26
Lead Width	b	0.15	–	0.40

Notes:

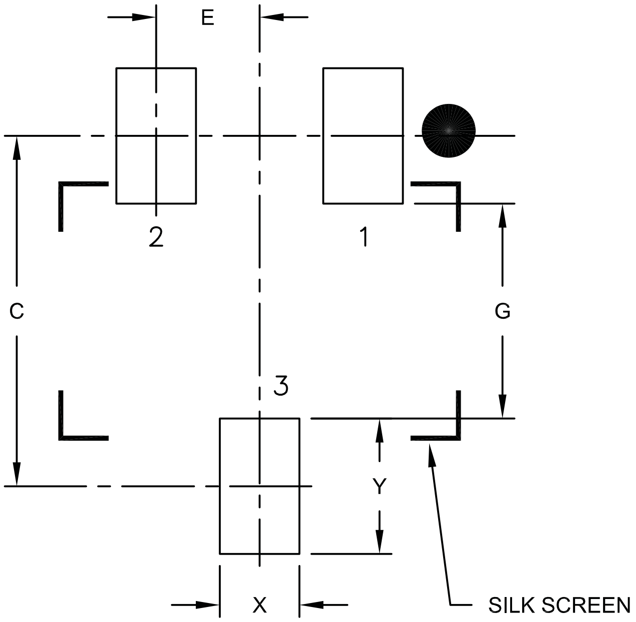
1. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.127 mm per side.
2. Dimensioning and tolerancing per ASME Y14.5M.

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-060B

3-Lead Plastic Small Outline Transistor (LB) [SC70]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

		Units	MILLIMETERS		
		Dimension Limits	MIN	NOM	MAX
Contact Pitch	E		0.65 BSC		
Contact Pad Spacing	C			2.20	
Contact Pad Width	X				0.50
Contact Pad Length	Y				0.95
Distance Between Pads	G		1.25		

Notes:

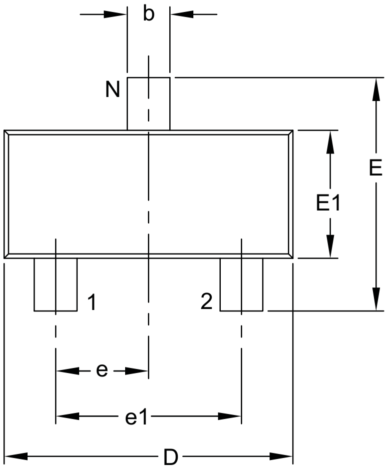
1. Dimensioning and tolerancing per ASME Y14.5M

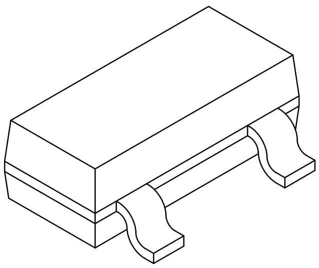
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

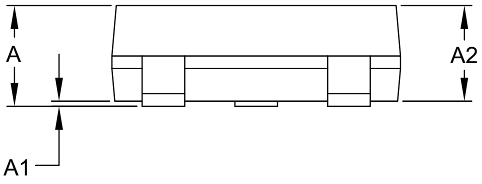
Microchip Technology Drawing No. C04-2060A

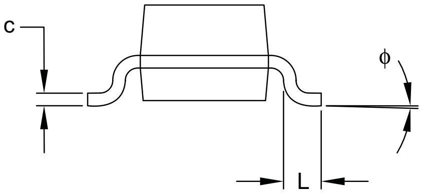
3-Lead Plastic Small Outline Transistor (TT) [SOT-23]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging









		Units	MILLIMETERS	
	Dimension Limits	MIN	NOM	MAX
Number of Pins	N		3	
Lead Pitch	e		0.95 BSC	
Outside Lead Pitch	e1		1.90 BSC	
Overall Height	A	0.89	–	1.12
Molded Package Thickness	A2	0.79	0.95	1.02
Standoff	A1	0.01	–	0.10
Overall Width	E	2.10	–	2.64
Molded Package Width	E1	1.16	1.30	1.40
Overall Length	D	2.67	2.90	3.05
Foot Length	L	0.13	0.50	0.60
Foot Angle	ϕ	0°	–	10°
Lead Thickness	c	0.08	–	0.20
Lead Width	b	0.30	–	0.54

Notes:

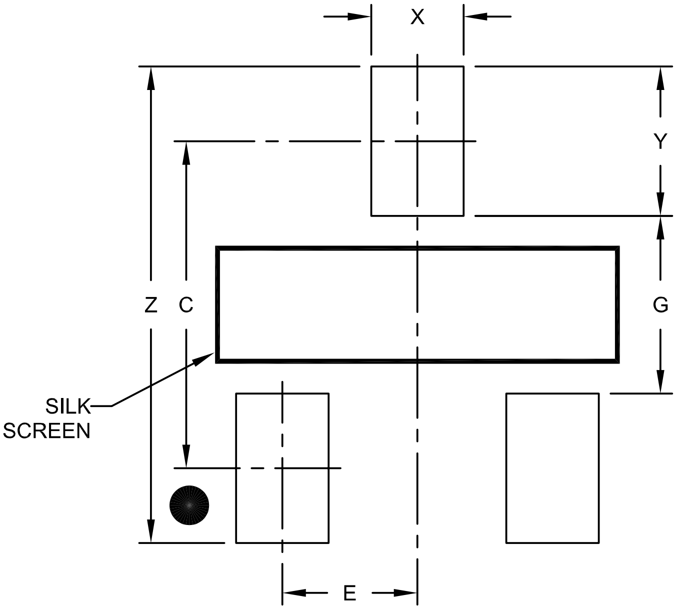
1. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.25 mm per side.
2. Dimensioning and tolerancing per ASME Y14.5M.

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-104B

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

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	0.95 BSC		
Contact Pad Spacing	C		2.30	
Contact Pad Width (X3)	X			0.65
Contact Pad Length (X3)	Y			1.05
Distance Between Pads	G	1.25		
Overall Width	Z			3.35

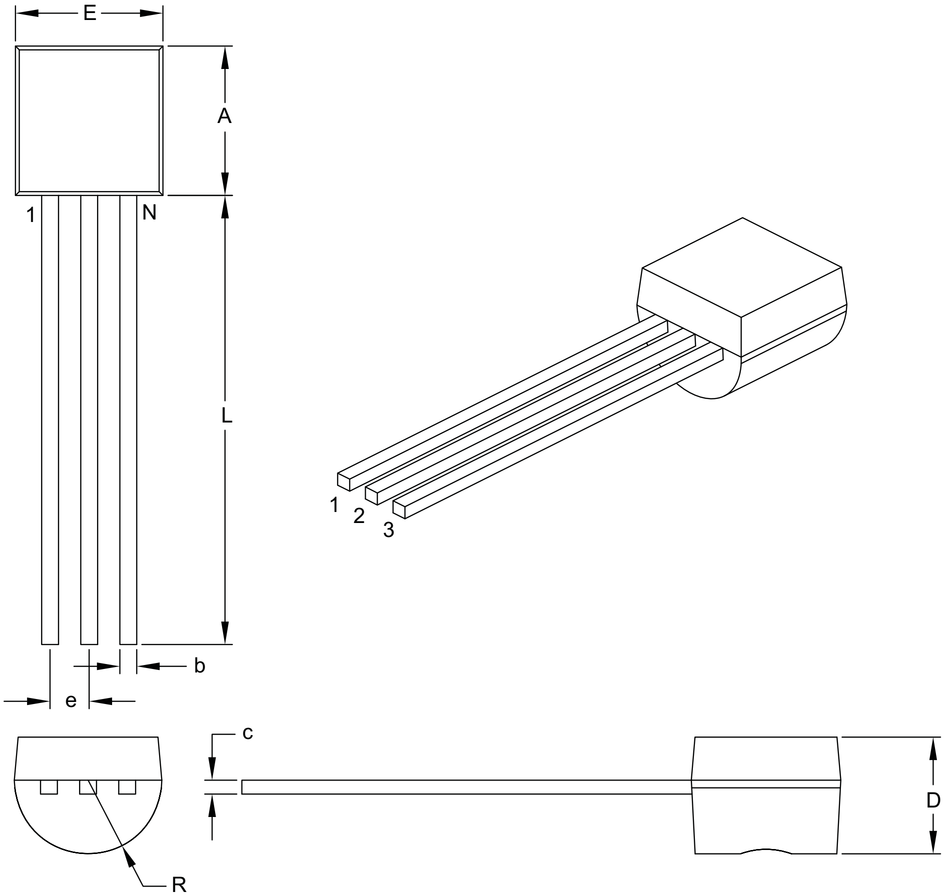
Notes:

1. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2104A

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

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		INCHES	
Dimension Limits		MIN	MAX
Number of Pins	N	3	
Pitch	e	.050 BSC	
Bottom to Package Flat	D	.125	.165
Overall Width	E	.175	.205
Overall Length	A	.170	.210
Molded Package Radius	R	.080	.105
Tip to Seating Plane	L	.500	–
Lead Thickness	c	.014	.021
Lead Width	b	.014	.022

Notes:

1. Dimensions A and E do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .005" per side.
2. Dimensioning and tolerancing per ASME Y14.5M.

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-101B

5.2 Product Tape and Reel Specifications

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

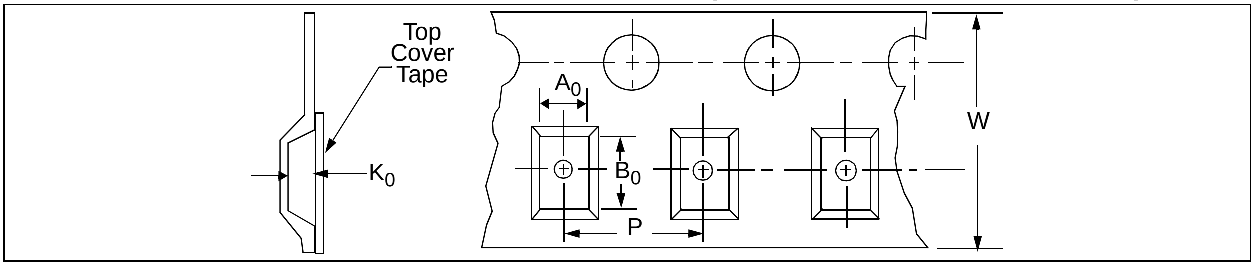
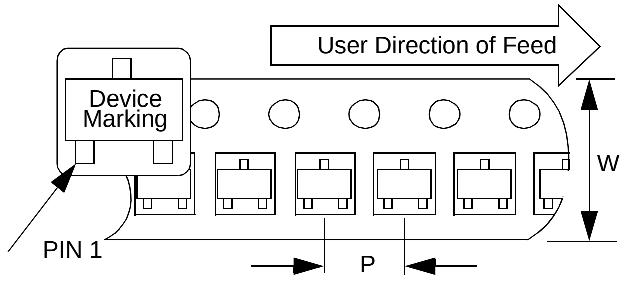


TABLE 5-1: CARRIER TAPE/CAVITY DIMENSIONS

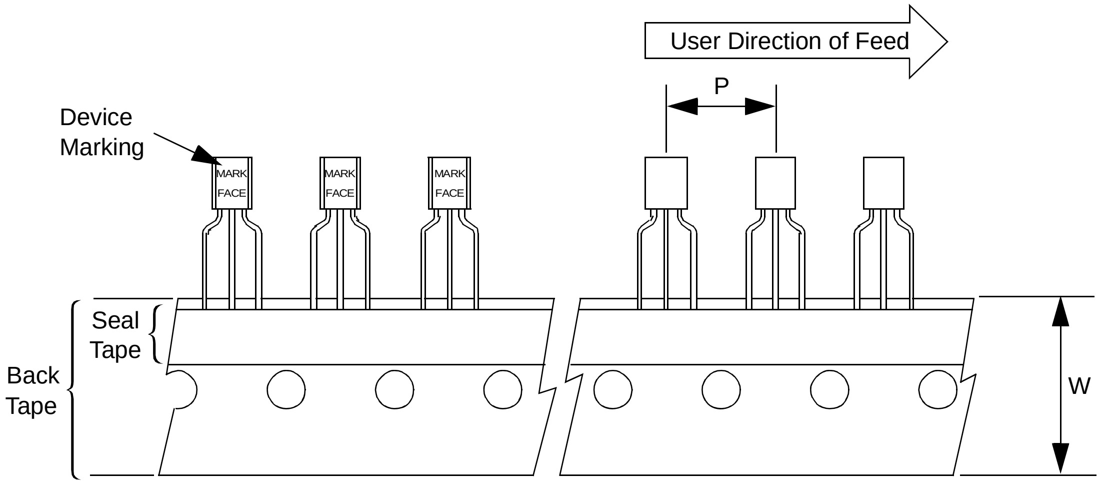
Case Outline	Package Type		Carrier Dimensions		Cavity Dimensions			Output Quantity Units	Reel Diameter in mm
			W mm	P mm	A0 mm	B0 mm	K0 mm		
TT	SOT-23	3L	8	4	3.15	2.77	1.22	3000	180
LB	SC70	3L	8	4	2.4	2.4	1.19	3000	180

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



Standard Reel Component Orientation

FIGURE 5-3: TO-92 DEVICE TAPE AND REEL SPECIFICATIONS



Note: Bent leads are for Tape and Reel only.

APPENDIX A: REVISION HISTORY

Revision D (February 2014)

The following is the list of modifications:

1. Updated Table 3-1.
2. Updated Figure 2-25.
3. Updated SC70, SOT-23 and TO-92 package drawings and markings in **Section 5.0 “Packaging Information”**.

Revision C (January 2013)

- Added a note to each package outline drawing.

Revision B (March 2005)

The following is the list of modifications:

1. Added **Section 4.4 “Usage in PIC® Microcontroller, ICSP™ Applications (MCP121 only)”** on using the MCP121 in PIC microcontroller ICSP applications.
2. Added V_{ODH} specifications in **Section 1.0 “Electrical Characteristics”** (for ICSP applications).
3. Added Figure 2-23.
4. Updated SC70 package markings and added Pb-free marking information to **Section 5.0 “Packaging Information”**.
5. Added **Appendix A: “Revision History”**.

Revision A (August 2004)

- Original Release of this Document.

NOTES:

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:

MCP102:	MicroPower Voltage Supervisor, push-pull
MCP102T:	MicroPower Voltage Supervisor, push-pull (Tape and Reel)
MCP103:	MicroPower Voltage Supervisor, push-pull
MCP103T:	MicroPower Voltage Supervisor, push-pull (Tape and Reel)
MCP121	MicroPower Voltage Supervisor, open-drain
MCP121T:	MicroPower Voltage Supervisor, open-drain (Tape and Reel)
MCP131	MicroPower Voltage Supervisor, open-drain
MCP131T:	MicroPower Voltage Supervisor, open-drain (Tape and Reel)

Monitoring Options:

195 = 1.90V
240 = 2.32V
270 = 2.63V
300 = 2.93V
315 = 3.08V
450 = 4.38V
475 = 4.63V

Temperature Range:

I = -40°C to +85°C (MCP1xx(T)-195 only)
E = -40°C to +125°C (Except for MCP1xx(T)-195)

Package:

TT = SOT-23, 3-lead
LB = SC70, 3-lead
TO = TO-92, 3-lead

Examples:

a)	MCP102T-195I/TT:	Tape and Reel, 1.95V MicroPower Voltage Supervisor, push-pull, -40°C to +85°C, SOT-23 package
b)	MCP102-300E/TO:	3.00V MicroPower Voltage Supervisor, push-pull, -40°C to +125°C, TO-92 package
a)	MCP103T-270E/TT:	Tape and Reel, 2.70V MicroPower Voltage Supervisor, push-pull, -40°C to +125°C, SOT-23 package
b)	MCP103T-475E/LB:	Tape and Reel, 4.75V MicroPower Voltage Supervisor, push-pull, -40°C to +125°C, SC70 package
a)	MCP121T-315E/LB:	Tape and Reel, 3.15V MicroPower Voltage Supervisor, open-drain, -40°C to +125°C, SC70 package
b)	MCP121-300E/TO:	3.00V MicroPower Voltage Supervisor, open-drain, -40°C to +125°C, TO-92 package
a)	MCP131T-195I/TT:	Tape and Reel, 1.95V MicroPower Voltage Supervisor, open-drain, -40°C to +85°C, SOT-23 package
b)	MCP131-300E/TO:	3.00V MicroPower Voltage Supervisor, open-drain, -40°C to +125°C, TO-92 package

NOTES:

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