

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, SC-70 and SOT-89-3 Packages
- Temperature Range:
 - Extended: -40°C to $+125^{\circ}\text{C}$ (except MCP1XX-195)
 - Industrial: -40°C to $+85^{\circ}\text{C}$ (MCP1XX-195 Only)
- Pb-Free Devices

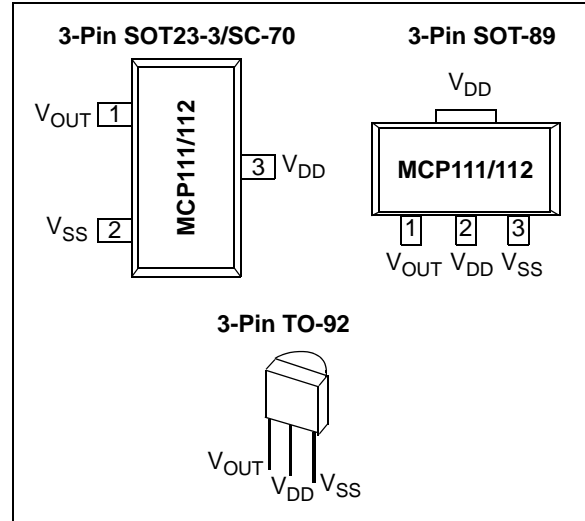
Applications

- Critical Microcontroller and Microprocessor Power-Monitoring Applications
- Computers
- Intelligent Instruments
- Portable Battery-Powered Equipment

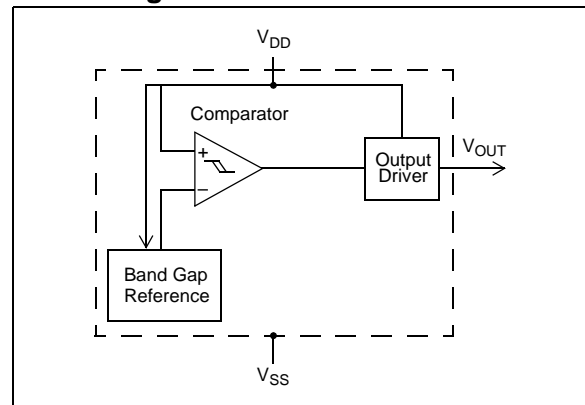
General Description

The MCP111/112 are voltage-detecting devices designed to keep a microcontroller in reset until the system voltage has 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 the specified threshold voltage level. Eight different trip voltages are available.

Package Types



Block Diagram



DEVICE FEATURES

Device	Output		Reset Delay (typ.)	SOT-23/SC70 Package Pin Out (Pin # 1, 2, 3)	Comment
	Type	Pull-up Resistor			
MCP111	Open-drain	External	No	$V_{\text{OUT}}, V_{\text{SS}}, V_{\text{DD}}$	
MCP112	Push-pull	No	No	$V_{\text{OUT}}, V_{\text{SS}}, V_{\text{DD}}$	
MCP102	Push-pull	No	120 ms	$\overline{\text{RST}}, V_{\text{DD}}, V_{\text{SS}}$	See MCP102/103/121/131 Data Sheet (DS20001906)
MCP103	Push-pull	No	120 ms	$V_{\text{SS}}, \overline{\text{RST}}, V_{\text{DD}}$	See MCP102/103/121/131 Data Sheet (DS20001906)
MCP121	Open-drain	External	120 ms	$\overline{\text{RST}}, V_{\text{DD}}, V_{\text{SS}}$	See MCP102/103/121/131 Data Sheet (DS20001906)
MCP131	Open-Drain	Internal ($\sim 95 \text{ k}\Omega$)	120 ms	$\overline{\text{RST}}, V_{\text{DD}}, V_{\text{SS}}$	See MCP102/103/121/131 Data Sheet (DS20001906)

MCP111/112

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings†

V_{DD}	7.0V
Input current (V_{DD})	10 mA
Output current (RST)	10 mA
Rated Rise Time of V_{DD}	100V/ μ s
All inputs and outputs (except RST) w.r.t. V_{SS}	-0.6V to ($V_{DD} + 1.0V$)
RST output w.r.t. V_{SS}	-0.6V to 13.5V
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, $R_{PU} = 100$ k Ω (only MCP111), $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$.

Parameters		Symbol	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	$I_{RST} = 10 \mu\text{A}$, $V_{RST} < 0.2V$
Operating Current		I_{DD}	—	< 1	1.75	μA	
V_{DD} Trip Point	MCP1XX-195	V_{TRIP}	1.872	1.900	1.929	V	$T_A = +25^\circ\text{C}$ (Note 1)
			1.853	1.900	1.948	V	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ (Note 2)
	MCP1XX-240		2.285	2.320	2.355	V	$T_A = +25^\circ\text{C}$ (Note 1)
			2.262	2.320	2.378	V	Note 2
	MCP1XX-270		2.591	2.630	2.670	V	$T_A = +25^\circ\text{C}$ (Note 1)
			2.564	2.630	2.696	V	Note 2
	MCP1XX-290		2.857	2.900	2.944	V	$T_A = +25^\circ\text{C}$ (Note 1)
			2.828	2.900	2.973	V	Note 2
	MCP1XX-300		2.886	2.930	2.974	V	$T_A = +25^\circ\text{C}$ (Note 1)
			2.857	2.930	3.003	V	Note 2
	MCP1XX-315		3.034	3.080	3.126	V	$T_A = +25^\circ\text{C}$ (Note 1)
			3.003	3.080	3.157	V	Note 2
	MCP1XX-450		4.314	4.380	4.446	V	$T_A = +25^\circ\text{C}$ (Note 1)
4.271		4.380	4.490	V	Note 2		
MCP1XX-475	4.561	4.630	4.700	V	$T_A = +25^\circ\text{C}$ (Note 1)		
	4.514	4.630	4.746	V	Note 2		
V_{DD} Trip Point Tempco		T_{TPCO}	—	± 100	—	ppm/ $^\circ\text{C}$	

- Note 1:** Trip point is $\pm 1.5\%$ from typical value.
Note 2: Trip point is $\pm 2.5\%$ from typical value.
Note 3: This specification allows this device to be used in PIC[®] microcontroller applications that require the In-Circuit Serial Programming[™] (ICSP[™]) feature (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 100 sec. Current into the V_{OUT} pin should be limited to 2 mA. It is recommended that the device operational temperature be maintained between 0°C to 70°C ($+25^\circ\text{C}$ preferred). For additional information, please refer to [Figure 2-28](#).
Note 4: This parameter is established by characterization and is not 100% tested.

DC CHARACTERISTICS (CONTINUED)

Electrical Specifications: Unless otherwise indicated, all limits are specified for $V_{DD} = 1V$ to $5.5V$, $R_{PU} = 100\text{ k}\Omega$ (only **MCP111**), $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$.

Parameters		Symbol	Min.	Typ.	Max.	Units	Conditions
Threshold Hysteresis (min. = 1%, max = 6%)	MCP1XX-195	V_{HYS}	0.019	—	0.114	V	$T_A = +25^\circ\text{C}$
	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	
V_{OUT} Low-level Output Voltage		V_{OL}	—	—	0.4	V	$I_{OL} = 500\text{ }\mu\text{A}$, $V_{DD} = V_{TRIP(MIN)}$
V_{OUT} High-level Output Voltage		V_{OH}	$V_{DD} - 0.6$	—	—	V	$I_{OH} = 1\text{ mA}$, For only MCP112 (push-pull output)
Open-drain High Voltage on Output		V_{ODH}	—	—	13.5 ⁽³⁾	V	MCP111 only, $V_{DD} = 3.0V$, Time voltage > 5.5V applied $\leq 100s$, current into pin limited to 2 mA, $+25^\circ\text{C}$ operation recommended Note 3 , Note 4
Open-drain Output Leakage Current (MCP111 only)		I_{OD}	—	0.1	—	μA	

- Note 1:** Trip point is $\pm 1.5\%$ from typical value.
- Note 2:** Trip point is $\pm 2.5\%$ from typical value.
- Note 3:** This specification allows this device to be used in PIC[®] microcontroller applications that require the In-Circuit Serial Programming™ (ICSP™) feature (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 100 sec. Current into the V_{OUT} pin should be limited to 2 mA. It is recommended that the device operational temperature be maintained between 0°C to 70°C ($+25^\circ\text{C}$ preferred). For additional information, please refer to [Figure 2-28](#).
- Note 4:** This parameter is established by characterization and is not 100% tested.

MCP111/112



FIGURE 1-1: Timing Diagram.

AC CHARACTERISTICS

Electrical Specifications: Unless otherwise indicated, all limits are specified for $V_{DD} = 1V$ to $5.5V$, $R_{PU} = 100\text{ k}\Omega$ (only MCP111), $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$.

Parameters	Symbol	Min.	Typ.	Max.	Units	Conditions
V_{DD} Detect to V_{OUT} Inactive	t_{RPU}	—	90	—	μs	Figure 1-1 and $C_L = 50\text{ pF}$ (Note 1)
V_{DD} Detect to V_{OUT} Active	t_{RPD}	—	130	—	μs	V_{DD} ramped from $V_{TRIP(MAX)} + 250\text{ mV}$ down to $V_{TRIP(MIN)} - 250\text{ mV}$, per Figure 1-1, $C_L = 50\text{ pF}$ (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, $C_L = 50\text{ pF}$ (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 $5.5V$, $R_{PU} = 100\text{ k}\Omega$ (MCP111 only), $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$.

Parameters	Symbol	Min.	Typ.	Max.	Units	Conditions
Temperature Ranges						
Specified Temperature Range	T_A	-40	—	+85	$^\circ\text{C}$	MCP1XX-195
Specified Temperature Range	T_A	-40	—	+125	$^\circ\text{C}$	Except MCP1XX-195
Maximum Junction Temperature	T_J	—	—	+150	$^\circ\text{C}$	
Storage Temperature Range	T_A	-65	—	+150	$^\circ\text{C}$	
Package Thermal Resistances						
Thermal Resistance, 3L-SOT23	θ_{JA}	—	336	—	$^\circ\text{C}/\text{W}$	
Thermal Resistance, 3L-SC-70	θ_{JA}	—	340	—	$^\circ\text{C}/\text{W}$	
Thermal Resistance, 3L-TO-92	θ_{JA}	—	131.9	—	$^\circ\text{C}/\text{W}$	
Thermal Resistance, 3L-SOT-89	θ_{JA}	—	110	—	$^\circ\text{C}/\text{W}$	

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 $5.5V$, $R_{PU} = 100\text{ k}\Omega$ (only **MCP111**; see **Figure 4-1**), $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$.

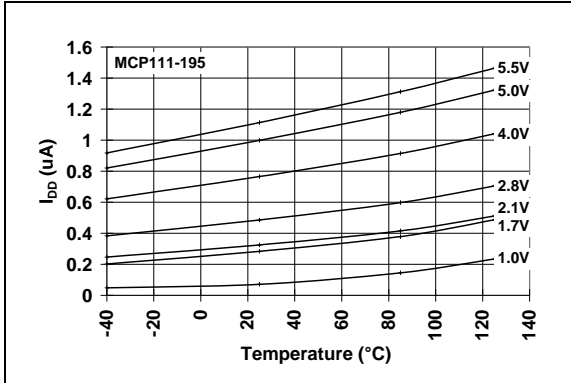


FIGURE 2-1: I_{DD} vs. Temperature (MCP111-195).

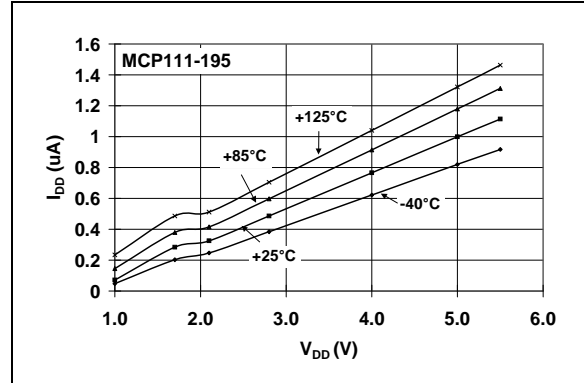


FIGURE 2-4: I_{DD} vs. V_{DD} (MCP111-195).

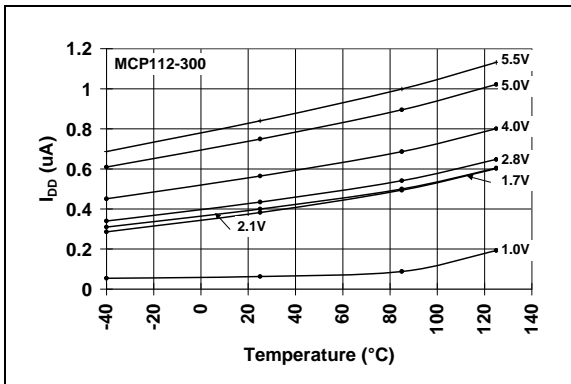


FIGURE 2-2: I_{DD} vs. Temperature (MCP112-300).

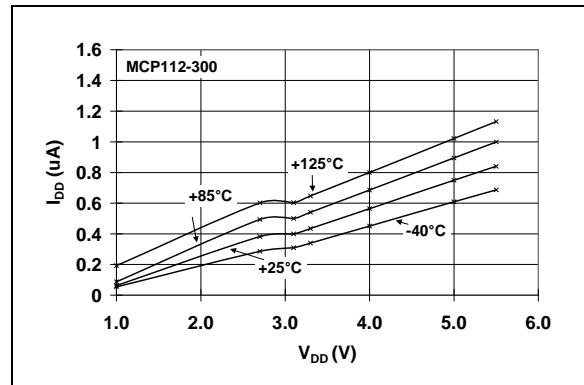


FIGURE 2-5: I_{DD} vs. V_{DD} (MCP112-300).

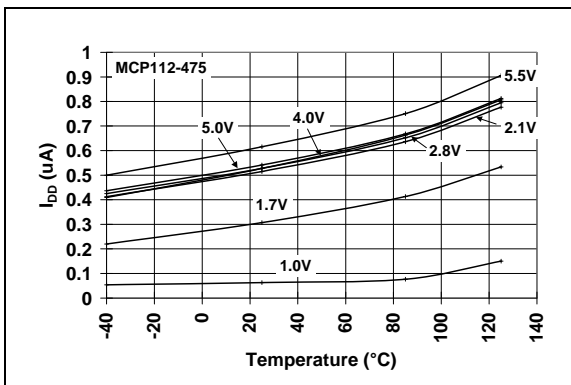


FIGURE 2-3: I_{DD} vs. Temperature (MCP112-475).

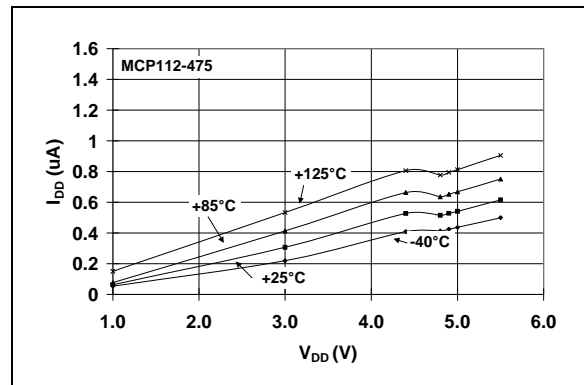


FIGURE 2-6: I_{DD} vs. V_{DD} (MCP112-475).

MCP111/112

Note: Unless otherwise indicated, all limits are specified for $V_{DD} = 1V$ to $5.5V$, $R_{PU} = 100\text{ k}\Omega$ (only MCP111; see Figure 4-1), $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$.



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

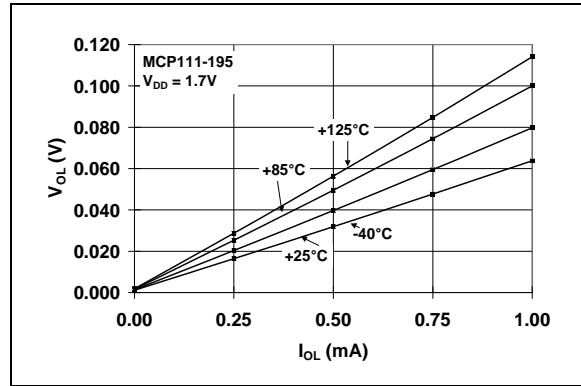


FIGURE 2-10: V_{OL} vs. I_{OL} (MCP111-195 @ $V_{DD} = 1.7V$).



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

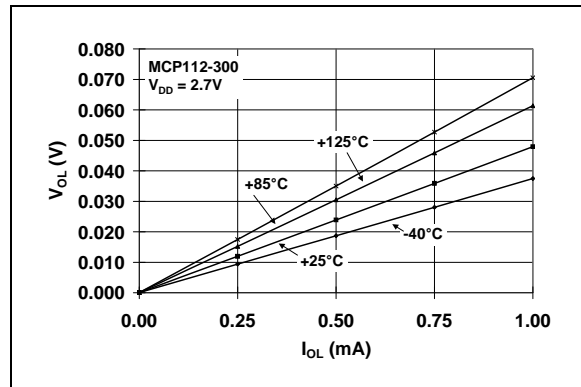


FIGURE 2-11: V_{OL} vs. I_{OL} (MCP112-300 @ $V_{DD} = 2.7V$).



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

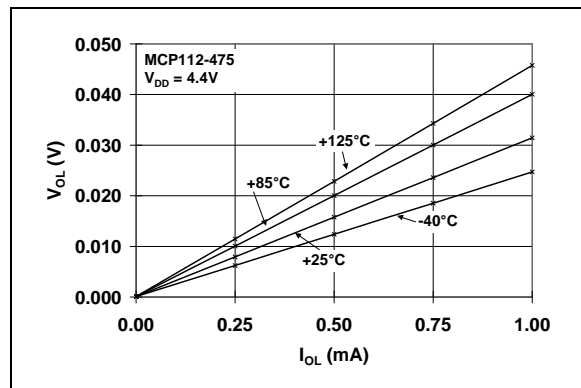


FIGURE 2-12: V_{OL} vs. I_{OL} (MCP112-475 @ $V_{DD} = 4.4V$).

Note: Unless otherwise indicated, all limits are specified for $V_{DD} = 1V$ to $5.5V$, $R_{PU} = 100\text{ k}\Omega$ (only MCP111; see Figure 4-1), $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$.



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



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



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



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



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



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

MCP111/112

Note: Unless otherwise indicated, all limits are specified for $V_{DD} = 1V$ to $5.5V$, $R_{PU} = 100\text{ k}\Omega$ (only MCP111; see Figure 4-1), $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$.



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

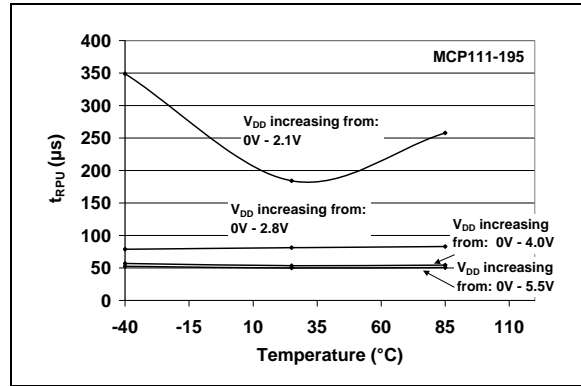


FIGURE 2-22: t_{RPU} vs. Temperature (MCP111-195).



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

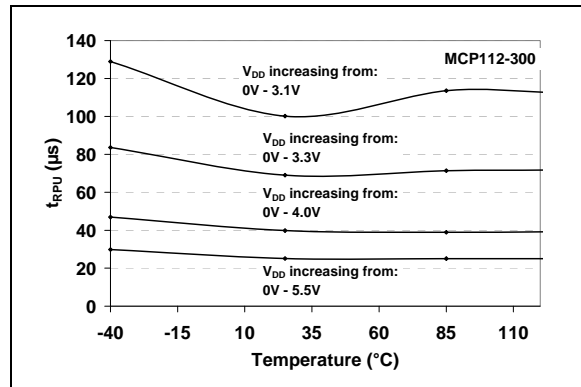


FIGURE 2-23: t_{RPU} vs. Temperature (MCP112-300).



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

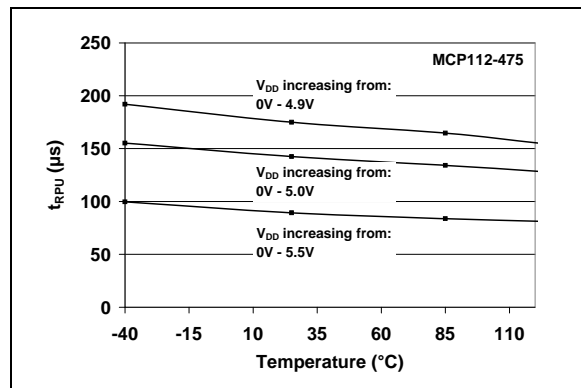


FIGURE 2-24: t_{RPU} vs. Temperature (MCP112-475).

Note: Unless otherwise indicated, all limits are specified for $V_{DD} = 1V$ to $5.5V$, $R_{PU} = 100\text{ k}\Omega$ (only MCP111; see Figure 4-1), $T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$.

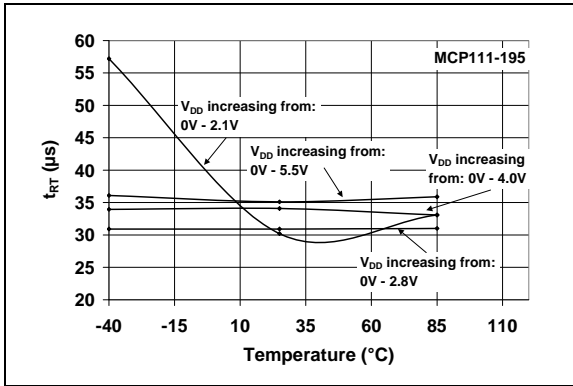


FIGURE 2-25: t_{RT} vs. Temperature (MCP111-195).

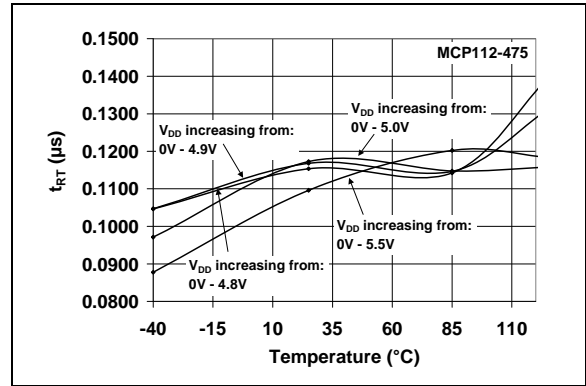


FIGURE 2-27: t_{RT} vs. Temperature (MCP112-475).

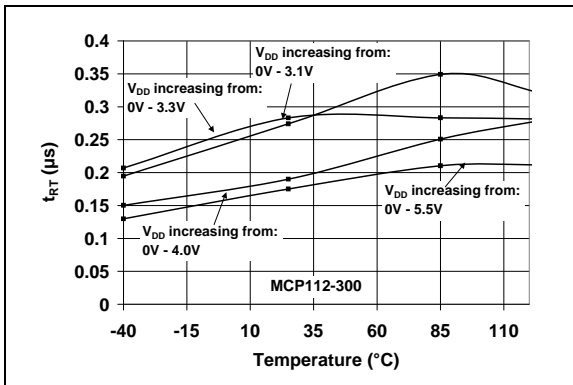


FIGURE 2-26: t_{RT} vs. Temperature (MCP112-300).

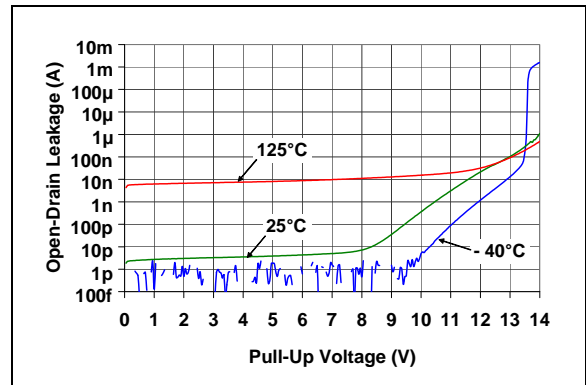


FIGURE 2-28: Open-Drain Leakage Current vs. Voltage Applied to V_{OUT} Pin (MCP111-195).

MCP111/112

3.0 PIN DESCRIPTION

The descriptions of the pins are listed in [Table 3-1](#).

TABLE 3-1: PIN FUNCTION TABLE

Pin Number			Symbol	Function
SOT-23-3 SC-70	SOT-89-3	T0-92		
1	1	1	V_{OUT}	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	3	V_{SS}	Ground reference
3	2	2	V_{DD}	Positive power supply
—	4	—	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 is a brown-out condition, 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.

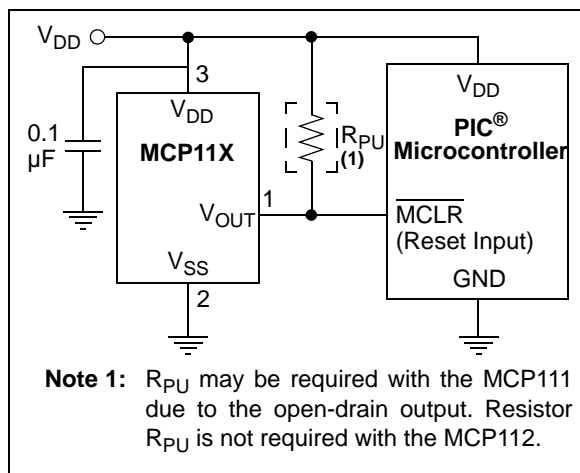


FIGURE 4-1: Typical Application Circuit.

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 $V_{TRIP} + V_{HYS}$.

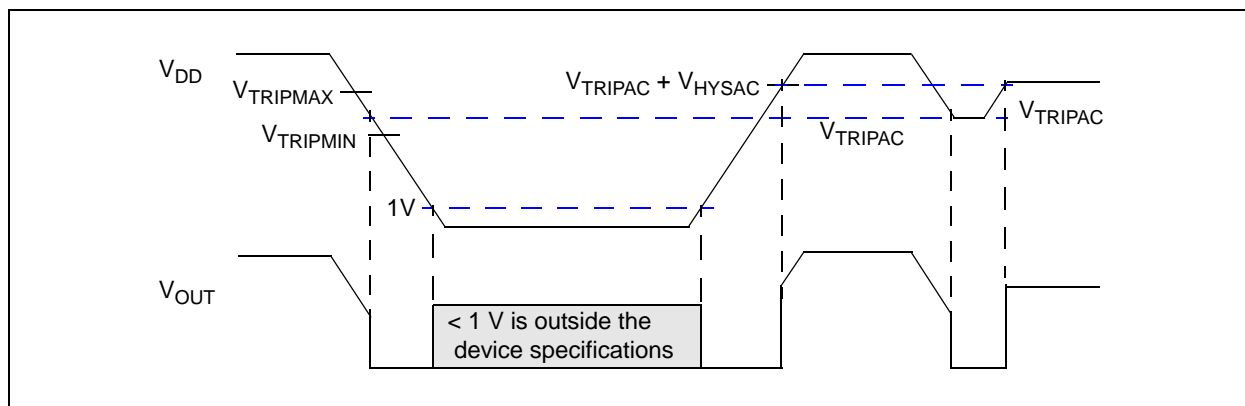


FIGURE 4-2: V_{OUT} Operation as Determined by the V_{TRIP} and V_{HYS} .

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

MCP111/112



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.

4.4 Using in PIC[®] Microcontroller ICSP[™] Applications (MCP111 only)

Figure 4-4 shows the typical application circuit for using the MCP111 for voltage supervisory function when the PIC microcontroller will be programmed via the In-Circuit Serial Programming[™] (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{RST} pin be current limited by a 1 k Ω resistor.

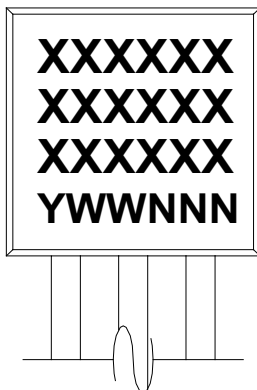


FIGURE 4-4: Typical Application Circuit for PIC[®] Microcontroller with the ICSP[™] feature.

5.0 PACKAGING INFORMATION

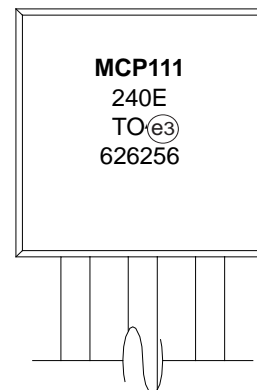
5.1 Package Marking Information

3-Lead TO-92



Device	Code
MCP111-240E/TO	240E
MCP111-270E/TO	270E
MCP111-290E/TO	290E
MCP111-300E/TO	300E
MCP111-315E/TO	315E
MCP111-450E/TO	450E
MCP111-475E/TO	475E
MCP111-195I/TO	195I

Example:



3-Lead SOT-23



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

Example:



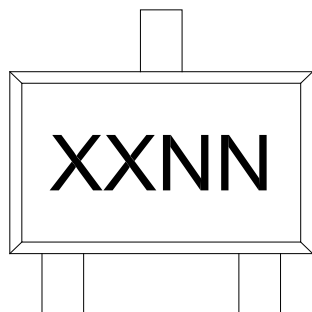
Legend:	XX...X	Customer-specific information
	Y	Year code (last digit of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator (e3) can be found on the 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.

MCP111/112

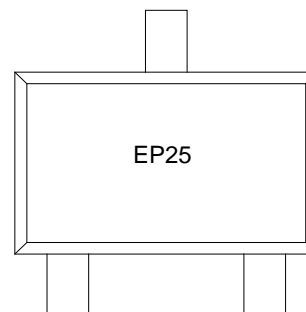
Package Marking Information (Continued)

3-Lead SC-70



Device	Code
MCP111T-195I/LB	EPNN
MCP111T-240E/LB	EQNN
MCP111T-270E/LB	EGNN
MCP111T-290E/LB	EHNN
MCP111T-300E/LB	EJNN
MCP111T-315E/LB	EKNN
MCP111T-450E/LB	ELNN
MCP111T-475E/LB	EMNN
MCP112T-195I/LB	ERNN
MCP112T-240E/LB	ESNN
MCP112T-270E/LB	EANN
MCP112T-290E/LB	EBNN
MCP112T-300E/LB	ECNN
MCP112T-315E/LB	EDNN
MCP112T-450E/LB	EENN
MCP112T-475E/LB	EFNN

Example:

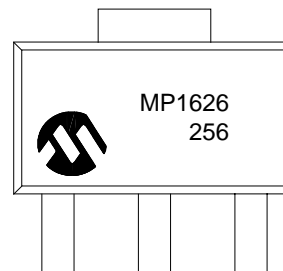


3-Lead SOT-89



Device	Code
MCP111T-195I/MB	MP
MCP111T-240EMB	MQ
MCP111T-270E/MB	MG
MCP111T-290E/MB	NH
MCP111T-300E/MB	MJ
MCP111T-315E/MB	MK
MCP111T-450E/MB	ML
MCP111T-475E/MB	MM
MCP112T-195I/MB	MR
MCP112T-240EMB	MS
MCP112T-270E/MB	MA
MCP112T-290E/MB	MB
MCP112T-300E/MB	MC
MCP112T-315E/MB	MD
MCP112T-450E/MB	ME
MCP112T-475E/MB	MF

Example:



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>



Dimension Limits	Units	INCHES	
		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:

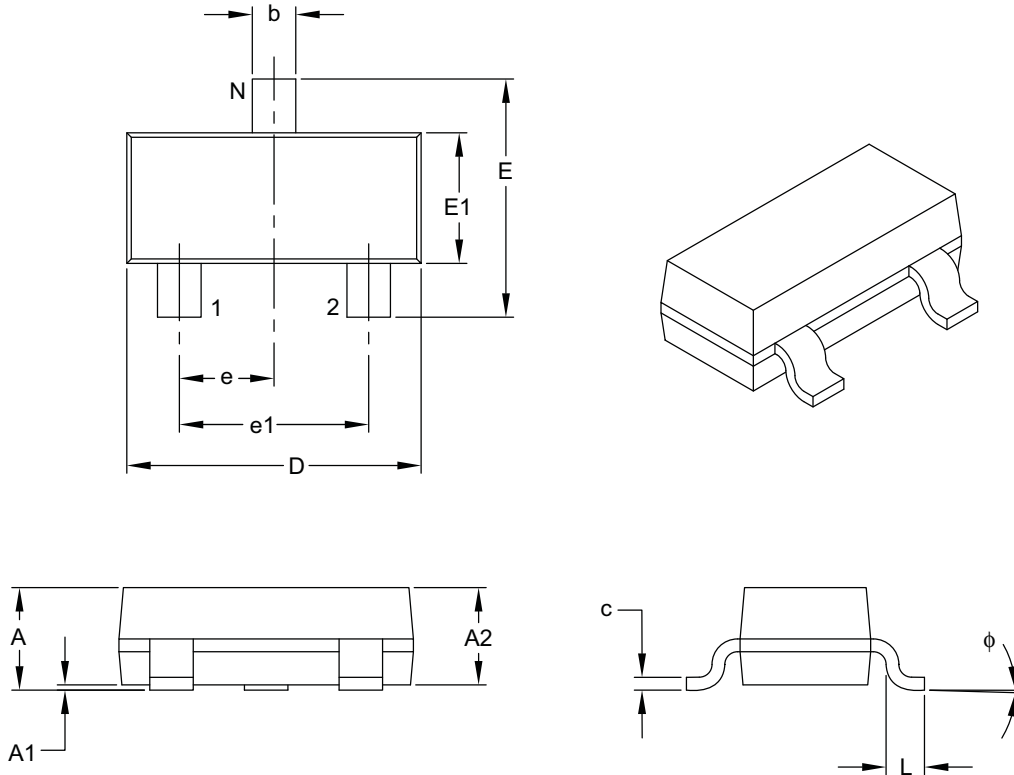
- Dimensions A and E do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .005" per side.
- Dimensioning and tolerancing per ASME Y14.5M.
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-101B

MCP111/112

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>



Dimension Limits	Units	MILLIMETERS		
		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

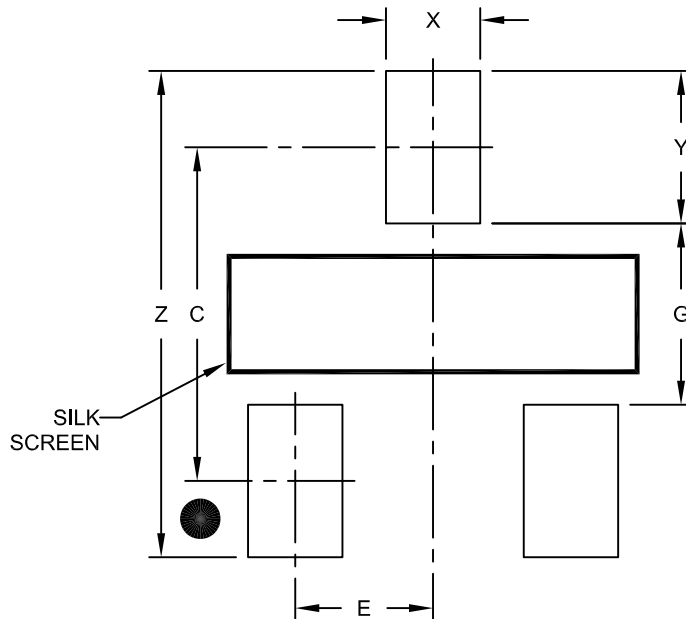
Notes:

- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.25 mm per side.
- 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

Dimension Limits	Units	MILLIMETERS		
		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

MCP111/112

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>



Microchip Technology Drawing C04-060C Sheet 1 of 2

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>



Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Number of Pins	N	3		
Pitch	e	0.65 BSC		
Overall Height	A	0.80	-	1.10
Standoff	A1	0.00	-	0.10
Molded Package Thickness	A2	0.80	-	1.00
Overall Length	D	2.00 BSC		
Exposed Pad Length	D2	2.50	2.60	2.70
Overall Width	E	2.10 BSC		
Exposed Pad Width	E1	1.25 BSC		
Terminal Width	b	0.15	-	0.40
Terminal Length	L	0.10	0.20	0.46
Lead Thickness	c	0.20	-	0.26

Notes:

- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
- Dimensioning and tolerancing per ASME Y14.5M
 BSC: Basic Dimension. Theoretically exact value shown without tolerances.
 REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-060C Sheet 2 of 2

MCP111/112

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

Dimension Limits	Units	MILLIMETERS		
		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			0.85
Distance Between Pads	G	1.25		

Notes:

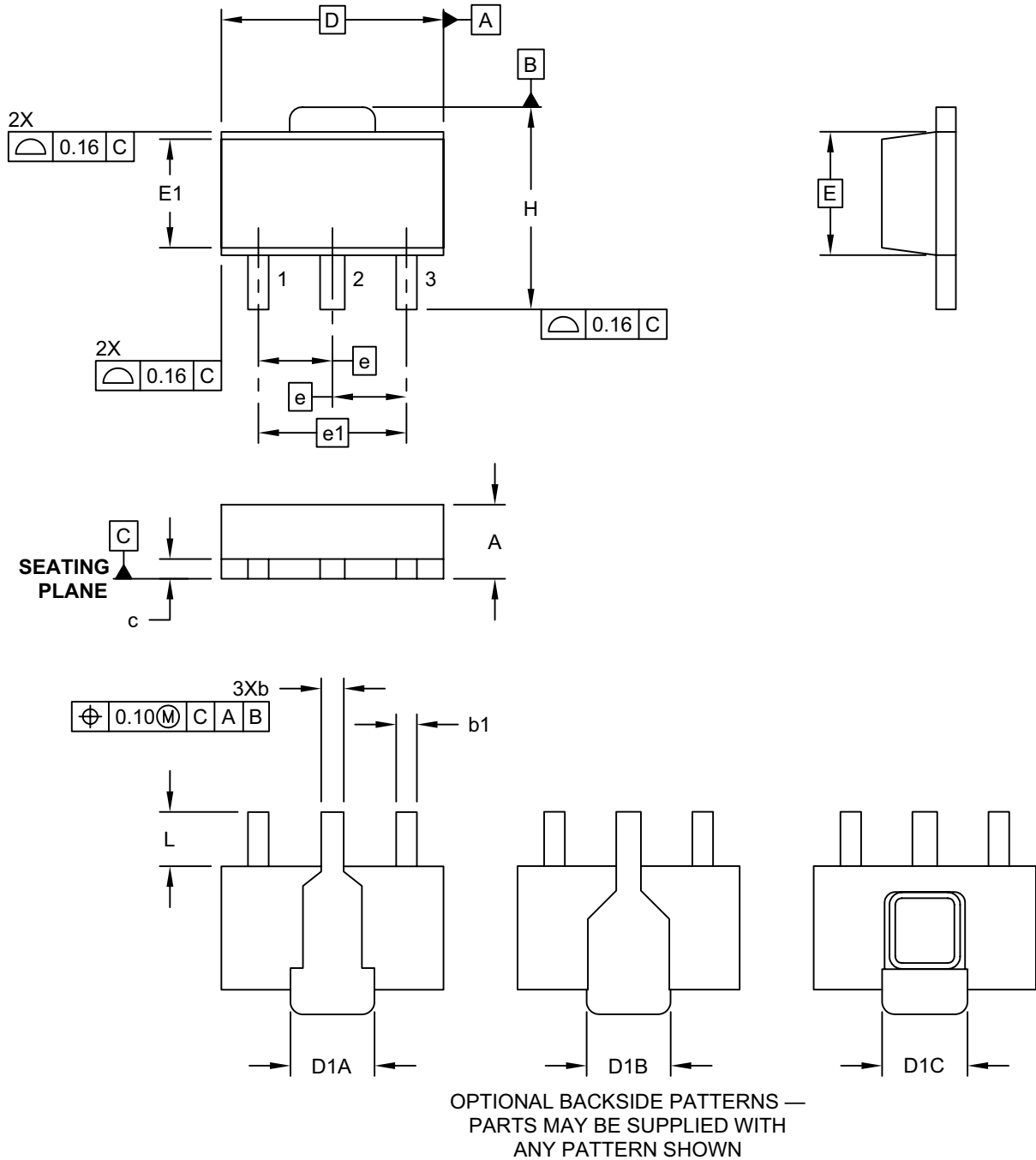
1. Dimensioning and tolerancing per ASME Y14.5M

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

Microchip Technology Drawing No. C04-2060B

3-Lead Plastic Small Outline Transistor (MB) - [SOT-89]

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

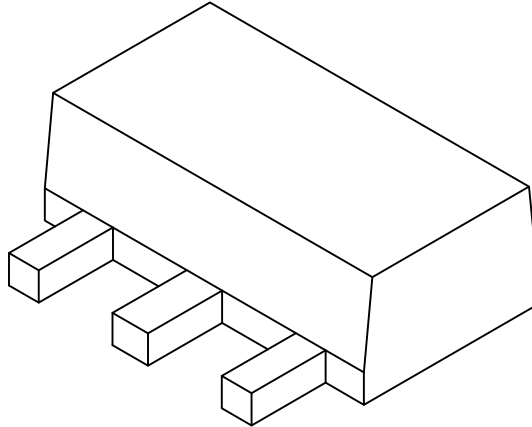


Microchip Technology Drawing C04-029C Sheet 1 of 2

MCP111/112

3-Lead Plastic Small Outline Transistor (MB) - [SOT-89]

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



Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Number of Leads	N	3		
Pitch	e	1.50 BSC		
Outside Lead Pitch	e1	3.00 BSC		
Overall Height	A	1.40	1.50	1.60
Overall Width	H	3.94	4.10	4.25
Molded Package Width at Base	E	2.50 BSC		
Molded Package Width at Top	E1	2.13	2.20	2.29
Overall Length	D	4.50 BSC		
Tab Length (Option A)	D1A	1.63	1.73	1.83
Tab Length (Option B)	D1B	1.40	1.60	1.75
Tab Length (Option C)	D1C	1.62	1.73	1.83
Foot Length	L	0.79	1.10	1.20
Lead Thickness	c	0.35	0.40	0.44
Lead 2 Width	b	0.41	0.50	0.56
Leads 1 & 3 Width	b1	0.36	0.42	0.48

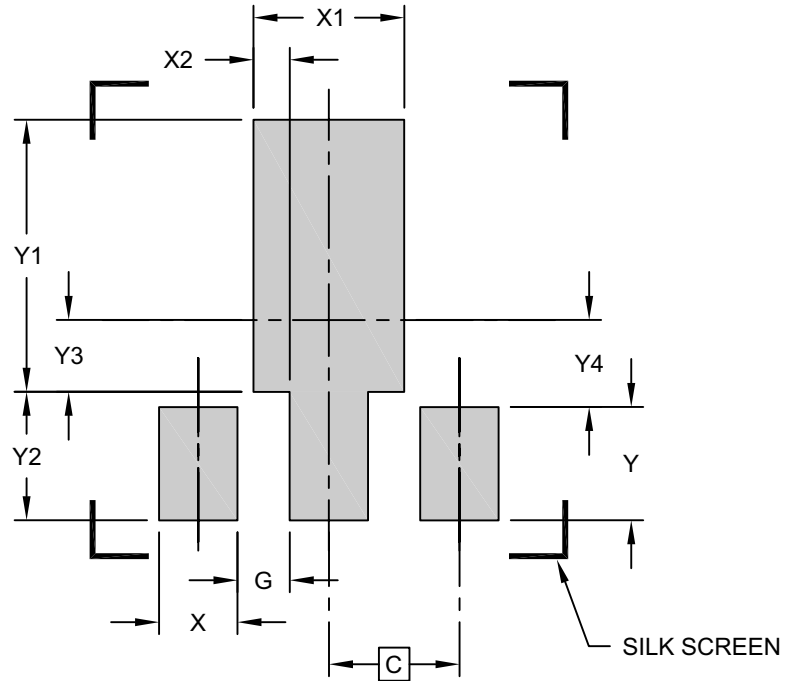
Notes:

1. Dimensions D and E do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.127mm per side.
2. Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-029C Sheet 2 of 2

3-Lead Plastic Small Outline Transistor (MB) - [SOT-89]

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		
	MIN	NOM	MAX
C	1.50 (BSC)		
X (3 PLACES)		0.900	
X1		1.733	
X2 (2 PLACES)		0.416	
G (2 PLACES)		0.600	
Y (2 PLACES)		1.300	
Y1		3.125	
Y2		1.475	
Y3		0.825	
Y4		1.000	

Notes:

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

Microchip Technology Drawing C04-2029C

MCP111/112

5.2 Product Tape and Reel Specifications

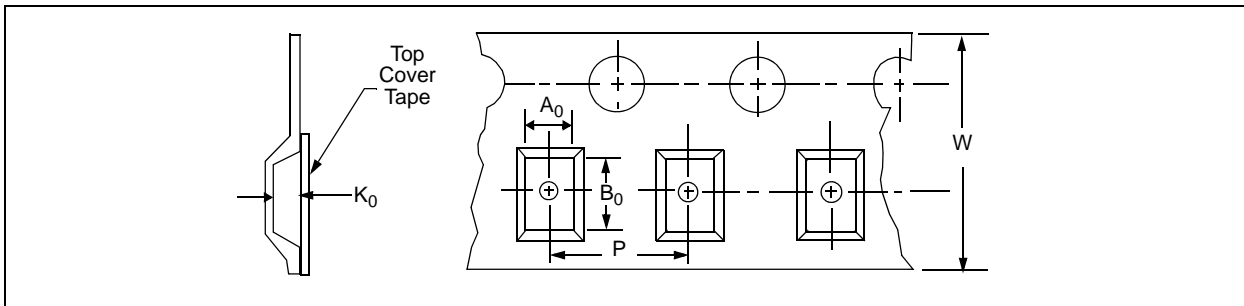


FIGURE 5-1: Embossed Carrier Dimensions (8, 12, 16 and 24 mm tape only).

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

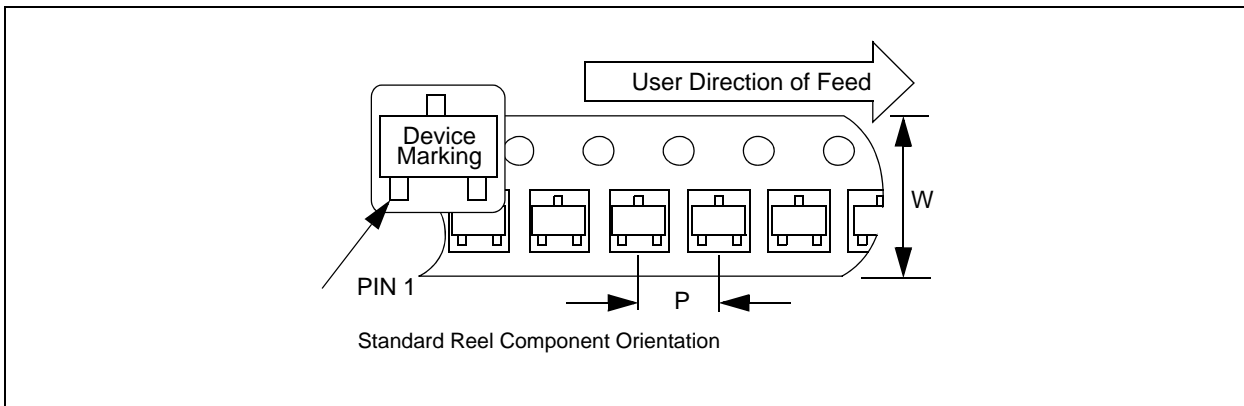


FIGURE 5-2: 3-Lead SOT-23/SC70 Device Tape and Reel Specifications.



FIGURE 5-3: TO-92 Devices.



FIGURE 5-4: SOT-89 Devices.

MCP111/112

NOTES:

APPENDIX A: REVISION HISTORY

Revision F (July 2016)

The following is the list of modifications:

1. Updated [Table 3-1](#).
2. Updated [Section 5.0 “Packaging information”](#).
3. Minor typographical corrections.

Revision E (January 2013)

- Added a note to each package outline drawing.

Revision D (June 2005)

1. Added SOT-89-3 package information throughout.

Revision C (March 2005)

The following is the list of modifications:

1. Added [Section 4.4 “Using in PIC® Microcontroller ICSP™ Applications \(MCP111 only\)”](#) on using the MCP111 in PIC microcontroller ICSP applications.
2. Added V_{ODH} specifications in [Section 1.0 “Electrical Characteristics”](#) (for ICSP applications).
3. Added Figure 2-28.
4. Added devices features table to page 1.
5. Updated SC-70 package markings and added Pb-free marking information to [Section 5.0 “Packaging information”](#).
6. Added [Appendix A: “Revision History”](#).

Revision B (August 2004)

1. Corrected package marking information in [Section 5.0 “Packaging information”](#).

Revision A (May 2004)

- Original release of this document.

MCP111/112

NOTES:

PRODUCT IDENTIFICATION SYSTEM

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

<u>PART NO.</u>	<u>X</u>	<u>XXX</u>	<u>X</u>	<u>XX</u>
Device	Tape/Reel Option	Monitoring Options	Temperature Range	Package
Device:				
		MCP111: MicroPower Voltage Detector, open-drain		
		MCP111T: MicroPower Voltage Detector, open-drain (Tape and Reel)		
		MCP112: MicroPower Voltage Detector, push-pull		
		MCP112T: MicroPower Voltage Detector, push-pull (Tape and Reel)		
Monitoring Options:		195 = 1.90V		
		240 = 2.32V		
		270 = 2.63V		
		290 = 2.90V		
		300 = 2.93V		
		315 = 3.08V		
		450 = 4.38V		
		475 = 4.63V		
Temperature Range:			I = -40°C to +85°C (MCP11X-195 only)	
			E = -40°C to +125°C (Except MCP11X-195 only)	
Package:				LB = SC-70, 3-lead
				MB = SOT-89, 3-lead
				TO = TO-92, 3-lead
				TT = SOT-23B, 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.		
d)	MCP111-315E/MB:	3.15V option, open-drain, -40°C to +125°C, SOT-89-3 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.		
d)	MCP112-315E/MB:	3.15V option, push-pull, -40°C to +125°C, SOT-89-3 package.		

MCP111/112

NOTES:

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as “unbreakable.”

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC[®] MCUs and dsPIC[®] DSCs, KEELoc[®] code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

**QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
= ISO/TS 16949 =**

Trademarks

The Microchip name and logo, the Microchip logo, AnyRate, dsPIC, FlashFlex, flexPWR, Heldo, JukeBlox, KeeLoq, KeeLoq logo, Klear, LANCheck, LINK MD, MediaLB, MOST, MOST logo, MPLAB, OptoLyzer, PIC, PICSTART, PIC32 logo, RightTouch, SpyNIC, SST, SST Logo, SuperFlash and UNI/O are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

ClockWorks, The Embedded Control Solutions Company, ETHERSYNCH, Hyper Speed Control, HyperLight Load, IntelliMOS, mTouch, Precision Edge, and QUIET-WIRE are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, BodyCom, chipKIT, chipKIT logo, CodeGuard, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, EtherGREEN, In-Circuit Serial Programming, ICSP, Inter-Chip Connectivity, JitterBlocker, KlearNet, KlearNet logo, MiWi, motorBench, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PureSilicon, RightTouch logo, REAL ICE, Ripple Blocker, Serial Quad I/O, SQL, SuperSwitcher, SuperSwitcher II, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

Silicon Storage Technology is a registered trademark of Microchip Technology Inc. in other countries.

GestIC is a registered trademarks of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

© 2004-2016, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

ISBN: 978-1-5224-0860-4



MICROCHIP

Worldwide Sales and Service

AMERICAS

Corporate Office

2355 West Chandler Blvd.
Chandler, AZ 85224-6199

Tel: 480-792-7200

Fax: 480-792-7277

Technical Support:

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

Web Address:

www.microchip.com

Atlanta

Duluth, GA

Tel: 678-957-9614

Fax: 678-957-1455

Austin, TX

Tel: 512-257-3370

Boston

Westborough, MA

Tel: 774-760-0087

Fax: 774-760-0088

Chicago

Itasca, IL

Tel: 630-285-0071

Fax: 630-285-0075

Cleveland

Independence, OH

Tel: 216-447-0464

Fax: 216-447-0643

Dallas

Addison, TX

Tel: 972-818-7423

Fax: 972-818-2924

Detroit

Novi, MI

Tel: 248-848-4000

Houston, TX

Tel: 281-894-5983

Indianapolis

Noblesville, IN

Tel: 317-773-8323

Fax: 317-773-5453

Los Angeles

Mission Viejo, CA

Tel: 949-462-9523

Fax: 949-462-9608

New York, NY

Tel: 631-435-6000

San Jose, CA

Tel: 408-735-9110

Canada - Toronto

Tel: 905-695-1980

Fax: 905-695-2078

ASIA/PACIFIC

Asia Pacific Office

Suites 3707-14, 37th Floor
Tower 6, The Gateway
Harbour City, Kowloon

Hong Kong

Tel: 852-2943-5100

Fax: 852-2401-3431

Australia - Sydney

Tel: 61-2-9868-6733

Fax: 61-2-9868-6755

China - Beijing

Tel: 86-10-8569-7000

Fax: 86-10-8528-2104

China - Chengdu

Tel: 86-28-8665-5511

Fax: 86-28-8665-7889

China - Chongqing

Tel: 86-23-8980-9588

Fax: 86-23-8980-9500

China - Dongguan

Tel: 86-769-8702-9880

China - Guangzhou

Tel: 86-20-8755-8029

China - Hangzhou

Tel: 86-571-8792-8115

Fax: 86-571-8792-8116

China - Hong Kong SAR

Tel: 852-2943-5100

Fax: 852-2401-3431

China - Nanjing

Tel: 86-25-8473-2460

Fax: 86-25-8473-2470

China - Qingdao

Tel: 86-532-8502-7355

Fax: 86-532-8502-7205

China - Shanghai

Tel: 86-21-5407-5533

Fax: 86-21-5407-5066

China - Shenyang

Tel: 86-24-2334-2829

Fax: 86-24-2334-2393

China - Shenzhen

Tel: 86-755-8864-2200

Fax: 86-755-8203-1760

China - Wuhan

Tel: 86-27-5980-5300

Fax: 86-27-5980-5118

China - Xian

Tel: 86-29-8833-7252

Fax: 86-29-8833-7256

ASIA/PACIFIC

China - Xiamen

Tel: 86-592-2388138

Fax: 86-592-2388130

China - Zhuhai

Tel: 86-756-3210040

Fax: 86-756-3210049

India - Bangalore

Tel: 91-80-3090-4444

Fax: 91-80-3090-4123

India - New Delhi

Tel: 91-11-4160-8631

Fax: 91-11-4160-8632

India - Pune

Tel: 91-20-3019-1500

Japan - Osaka

Tel: 81-6-6152-7160

Fax: 81-6-6152-9310

Japan - Tokyo

Tel: 81-3-6880-3770

Fax: 81-3-6880-3771

Korea - Daegu

Tel: 82-53-744-4301

Fax: 82-53-744-4302

Korea - Seoul

Tel: 82-2-554-7200

Fax: 82-2-558-5932 or

82-2-558-5934

Malaysia - Kuala Lumpur

Tel: 60-3-6201-9857

Fax: 60-3-6201-9859

Malaysia - Penang

Tel: 60-4-227-8870

Fax: 60-4-227-4068

Philippines - Manila

Tel: 63-2-634-9065

Fax: 63-2-634-9069

Singapore

Tel: 65-6334-8870

Fax: 65-6334-8850

Taiwan - Hsin Chu

Tel: 886-3-5778-366

Fax: 886-3-5770-955

Taiwan - Kaohsiung

Tel: 886-7-213-7828

Taiwan - Taipei

Tel: 886-2-2508-8600

Fax: 886-2-2508-0102

Thailand - Bangkok

Tel: 66-2-694-1351

Fax: 66-2-694-1350

EUROPE

Austria - Wels

Tel: 43-7242-2244-39

Fax: 43-7242-2244-393

Denmark - Copenhagen

Tel: 45-4450-2828

Fax: 45-4485-2829

France - Paris

Tel: 33-1-69-53-63-20

Fax: 33-1-69-30-90-79

Germany - Dusseldorf

Tel: 49-2129-3766400

Germany - Karlsruhe

Tel: 49-721-625370

Germany - Munich

Tel: 49-89-627-144-0

Fax: 49-89-627-144-44

Italy - Milan

Tel: 39-0331-742611

Fax: 39-0331-466781

Italy - Venice

Tel: 39-049-7625286

Netherlands - Drunen

Tel: 31-416-690399

Fax: 31-416-690340

Poland - Warsaw

Tel: 48-22-3325737

Spain - Madrid

Tel: 34-91-708-08-90

Fax: 34-91-708-08-91

Sweden - Stockholm

Tel: 46-8-5090-4654

UK - Wokingham

Tel: 44-118-921-5800

Fax: 44-118-921-5820

06/23/16

Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

- ⊖ [View MCP111T-450E/TT on WIN SOURCE](#)
- ⊖ [Microchip Technology](#) Information

Optimize Your Supply Chain with WIN SOURCE Solutions

- ✓ Global Sourcing Solution
- ✓ Obsolete Management
- ✓ Cost Control Management
- ✓ Shortage Management
- ✓ Alternative Solution
- ✓ Excess Inventory Management