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, SC-70 and SOT-89-3 packages
- Temperature Range:
  - Extended: -40°C to +125°C (**except MCP1XX-195**)
  - Industrial: -40°C to +85°C (**MCP1XX-195 only**)
- Pb-free devices

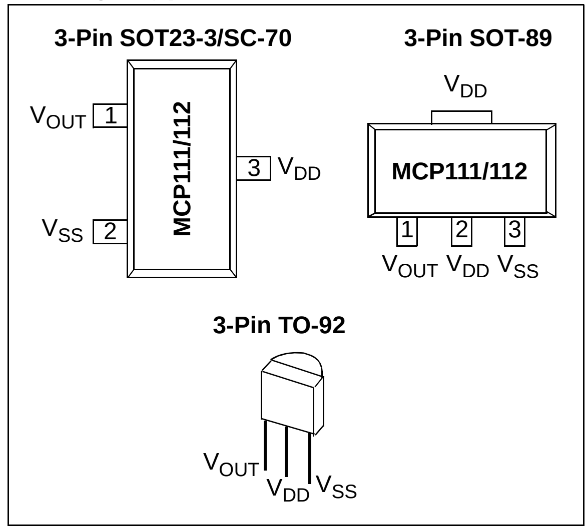
Applications

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

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

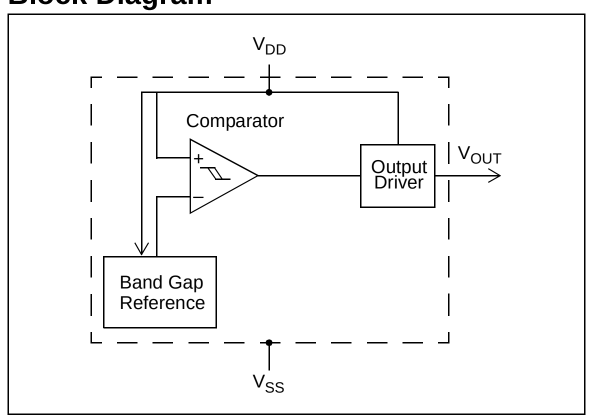


TABLE 1: DEVICE FEATURES

Device	Output		Reset Delay (typ)	Package Pin Out (Pin # 1, 2, 3)	Comment
	Type	Pull-up Resistor			
MCP111	Open-drain	External	No	V_{OUT}, V_{SS}, V_{DD}	
MCP112	Push-pull	No	No	V_{OUT}, V_{SS}, V_{DD}	
MCP102	Push-pull	No	120 ms	$\overline{RST}$, V_{DD}, V_{SS}	See **MCP102/103/121/131** Data Sheet (DS21906)
MCP103	Push-pull	No	120 ms	Vss, $\overline{RST}$, V_{DD}	See **MCP102/103/121/131** Data Sheet (DS21906)
MCP121	Open-drain	External	120 ms	$\overline{RST}$, V_{DD}, V_{SS}	See **MCP102/103/121/131** Data Sheet (DS21906)
MCP131	Open-Drain	Internal (~95 kΩ)	120 ms	$\overline{RST}$, V_{DD}, V_{SS}	See **MCP102/103/121/131** Data Sheet (DS21906)

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 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	

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

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

3: This specification allows this device to be used in PICmicro® 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°C preferred). For additional information, please refer to Figure 2-28.

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 kΩ (only **MCP111**), T_A = -40°C to +125°C.							
Parameters		**Sym**	**Min**	**Typ**	**Max**	**Units**	**Conditions**
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	
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 High Voltage on Output		V_{ODH}	—	—	13.5 **(3)**	V	**MCP111** only, V_{DD} = 3.0V, Time voltage > 5.5V applied ≤ 100s, current into pin limited to 2 mA, +25°C operation recommended **Note 3, Note 4**
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.

3: This specification allows this device to be used in PICmicro® 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°C preferred). For additional information, please refer to Figure 2-28.

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

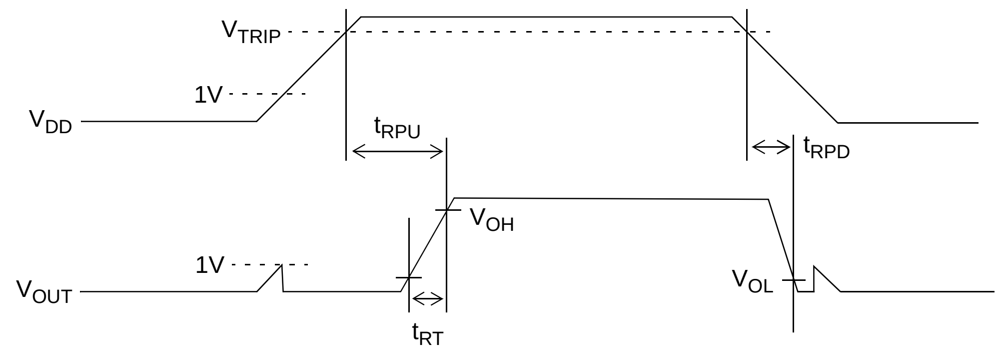


FIGURE 1-1: Timing Diagram.

AC CHARACTERISTICS

Electrical Specifications: Unless otherwise indicated, all limits are specified for V_{DD} = 1V to 5.5V, R_{PU} = 100 kΩ (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	θ_{JA}	—	336	—	°C/W	
Thermal Resistance, 3L-SC-70	θ_{JA}	—	340	—	°C/W	
Thermal Resistance, 3L-TO-92	θ_{JA}	—	131.9	—	°C/W	
Thermal Resistance, 3L-SOT-89	θ_{JA}	—	110	—	°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.

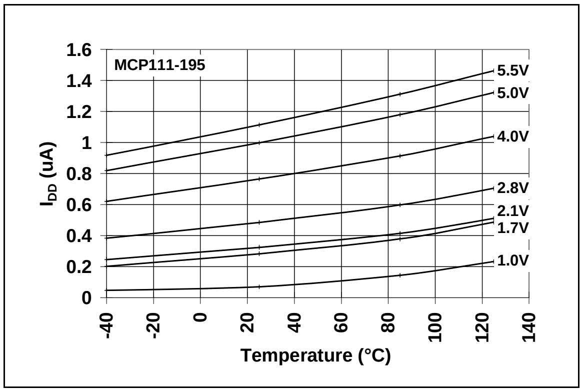


*FIGURE 2-1: I_{DD} vs. Temperature (**MCP111-195**).*

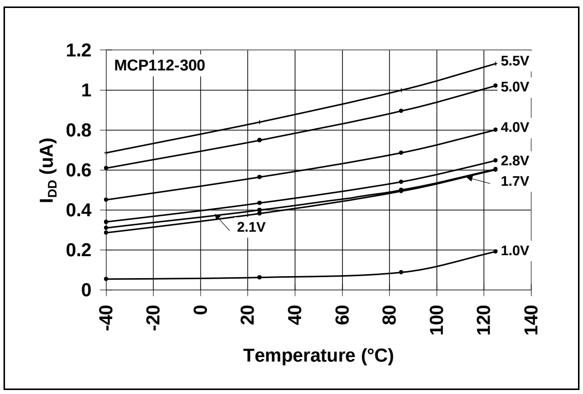


*FIGURE 2-2: I_{DD} vs. Temperature (**MCP112-300**).*

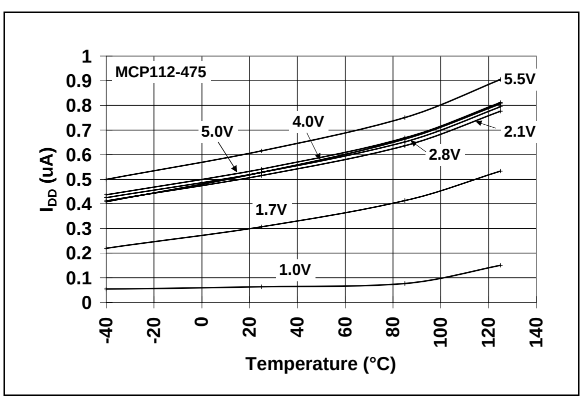


*FIGURE 2-3: I_{DD} vs. Temperature (**MCP112-475**).*

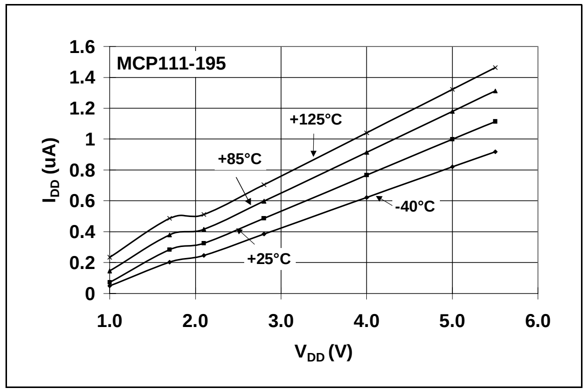


*FIGURE 2-4: I_{DD} vs. V_{DD} (**MCP111-195**).*

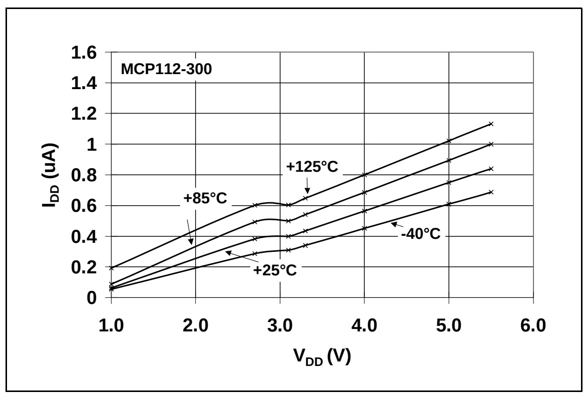


*FIGURE 2-5: I_{DD} vs. V_{DD} (**MCP112-300**).*

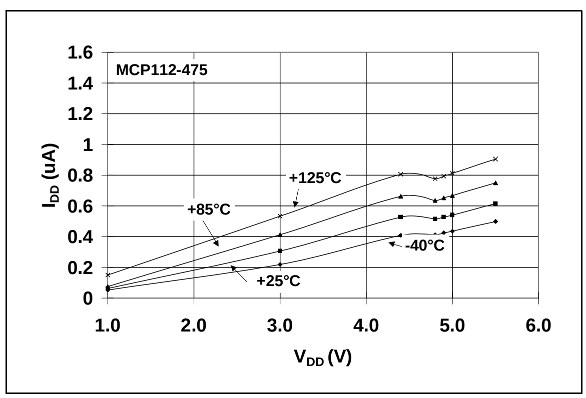


*FIGURE 2-6: I_{DD} vs. V_{DD} (**MCP112-475**).*

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.

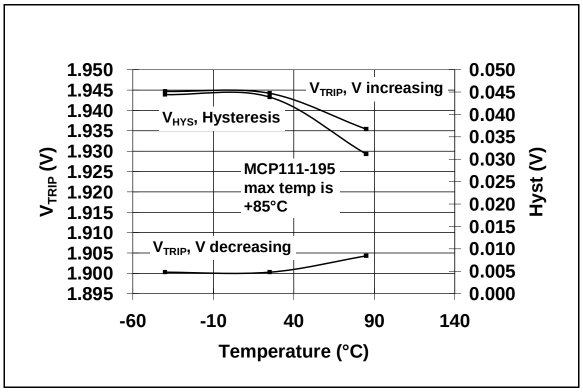


FIGURE 2-7: *V_{TRIP} and V_{HYST} vs. Temperature (**MCP111-195**).*

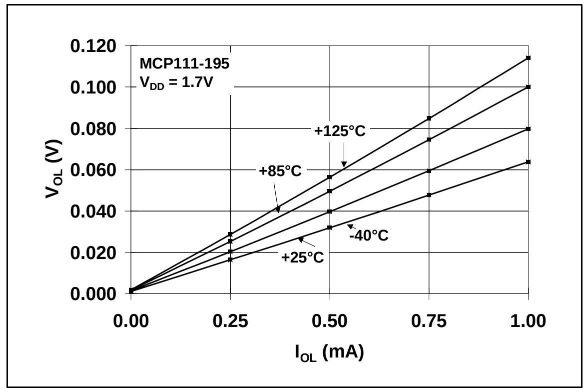


FIGURE 2-10: *V_{OL} vs. I_{OL} (**MCP111-195** @ V_{DD} = 1.7V).*

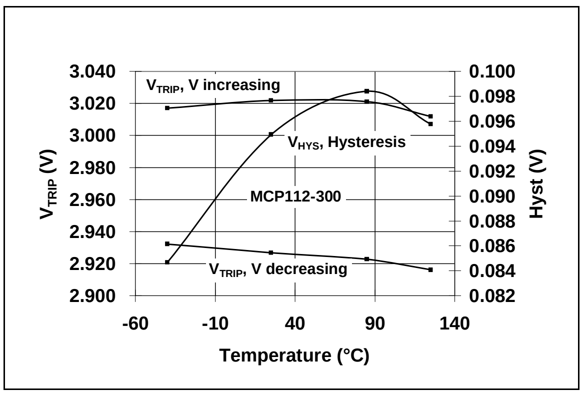


FIGURE 2-8: *V_{TRIP} and V_{HYST} vs. Temperature (**MCP112-300**).*

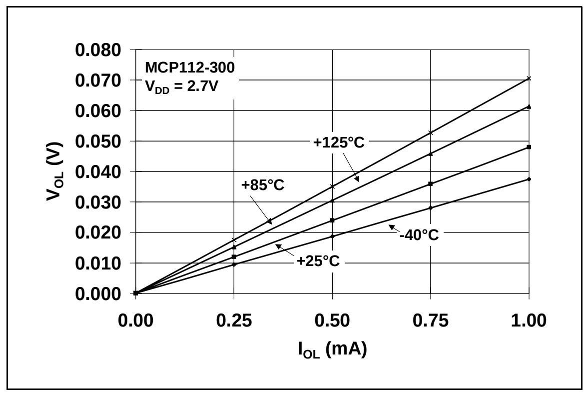


FIGURE 2-11: *V_{OL} vs. I_{OL} (**MCP112-300** @ V_{DD} = 2.7V).*

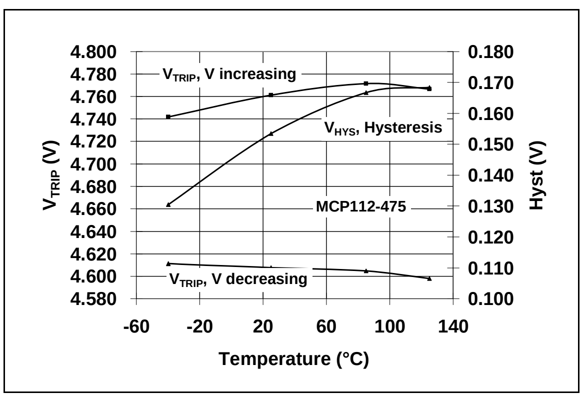


FIGURE 2-9: *V_{TRIP} and V_{HYST} vs. Temperature (**MCP112-475**).*

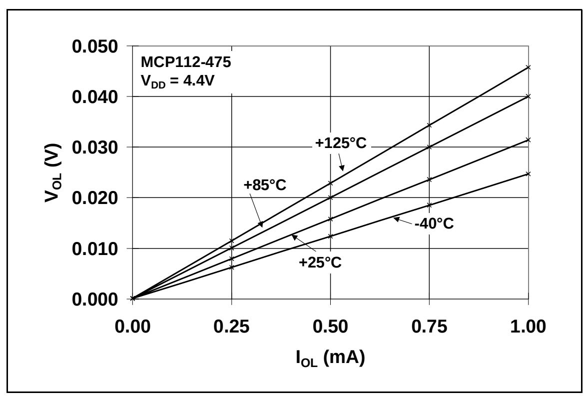


FIGURE 2-12: *V_{OL} vs. I_{OL} (**MCP112-475** @ V_{DD} = 4.4V).*

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.

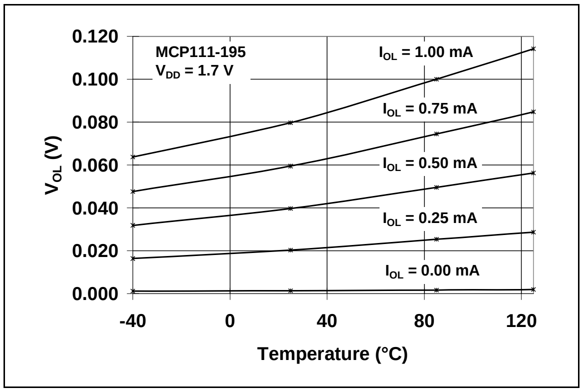


FIGURE 2-13: *V_{OL} vs. Temperature (**MCP111-195** @ V_{DD} = 1.7V).*

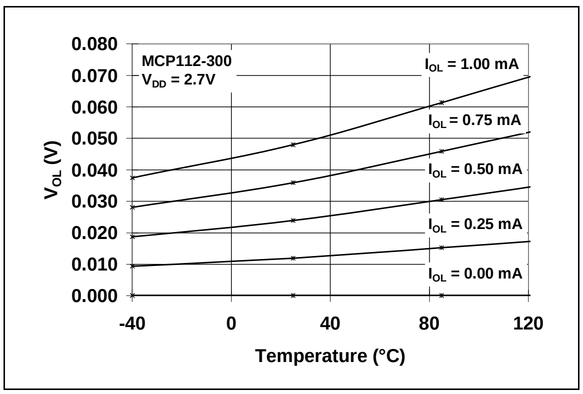


FIGURE 2-14: *V_{OL} vs. Temperature (**MCP112-300** @ V_{DD} = 2.7V).*

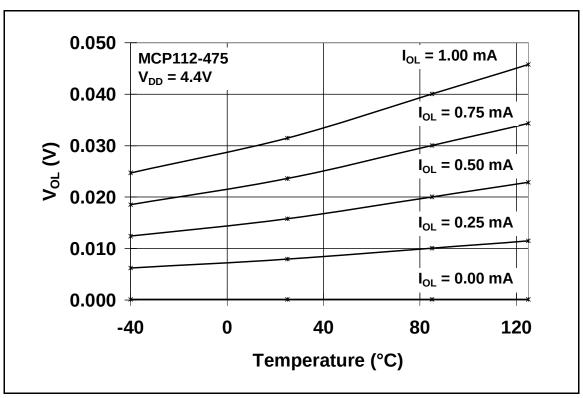


FIGURE 2-15: *V_{OL} vs. Temperature (**MCP112-475** @ V_{DD} = 4.4V).*

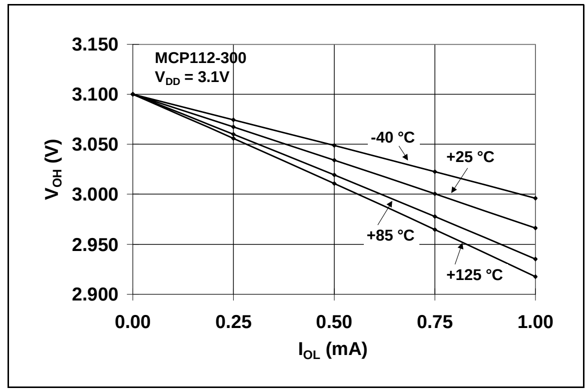


FIGURE 2-16: *V_{OH} vs. I_{OH} (**MCP112-300** @ V_{DD} = 3.1V).*

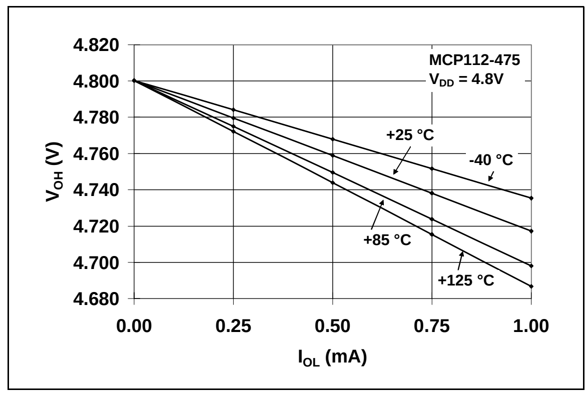


FIGURE 2-17: *V_{OH} vs. I_{OH} (**MCP112-475** @ V_{DD} = 4.8V).*

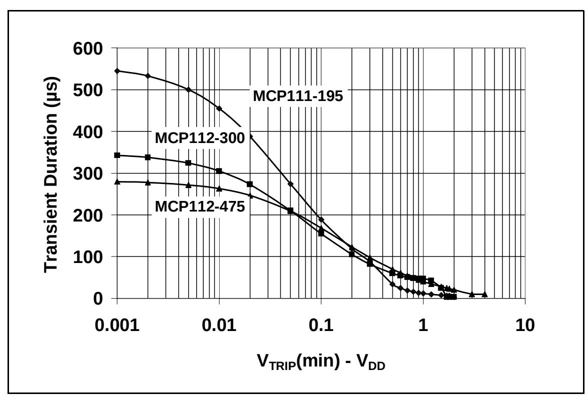


FIGURE 2-18: *Typical Transient Response (25 °C).*

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.

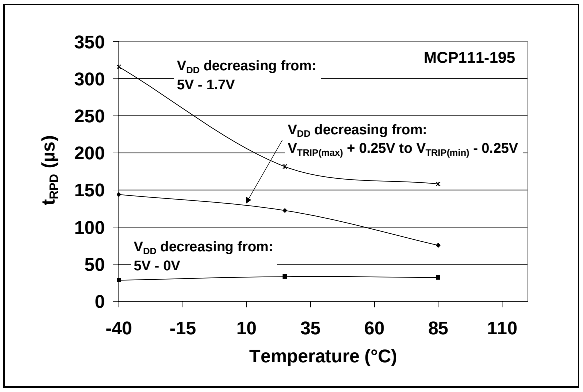


FIGURE 2-19: *t_{RPD} vs. Temperature (**MCP111-195**).*

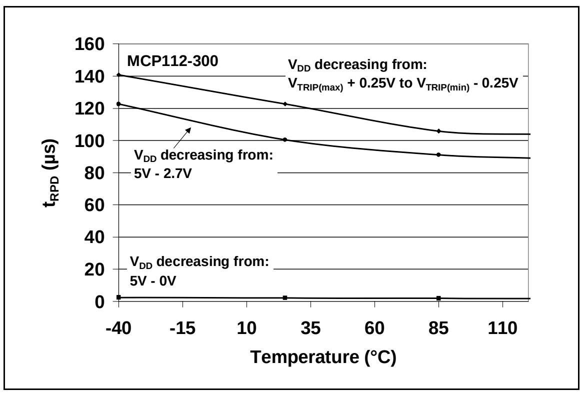


FIGURE 2-20: *t_{RPD} vs. Temperature (**MCP112-300**).*

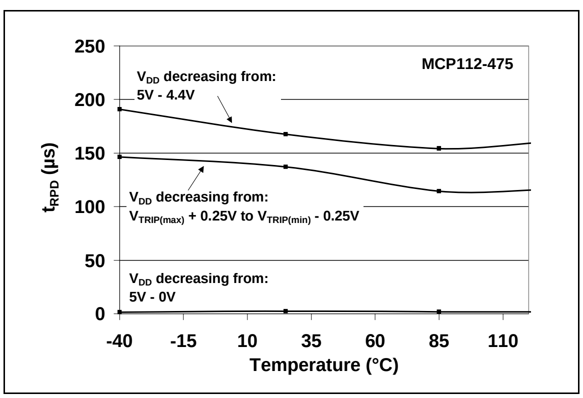


FIGURE 2-21: *t_{RPD} vs. Temperature (**MCP112-475**).*

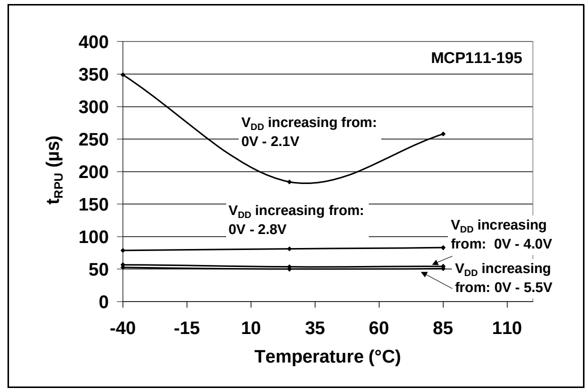


FIGURE 2-22: *t_{RPU} vs. Temperature (**MCP111-195**).*

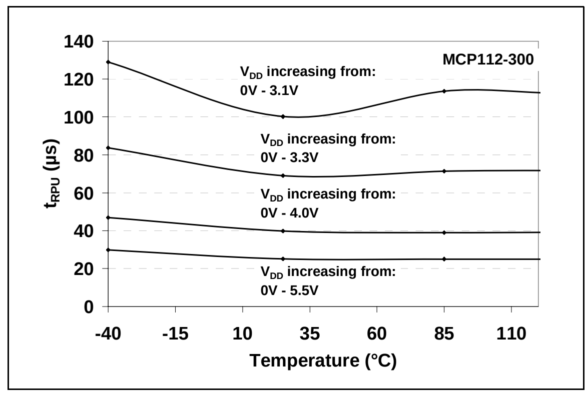


FIGURE 2-23: *t_{RPU} vs. Temperature (**MCP112-300**).*

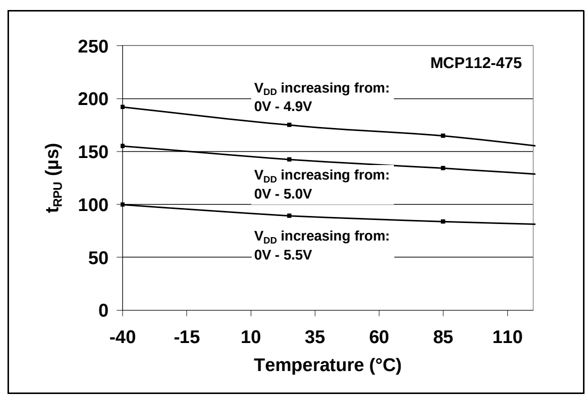


FIGURE 2-24: *t_{RPU} vs. Temperature (**MCP112-475**).*

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.

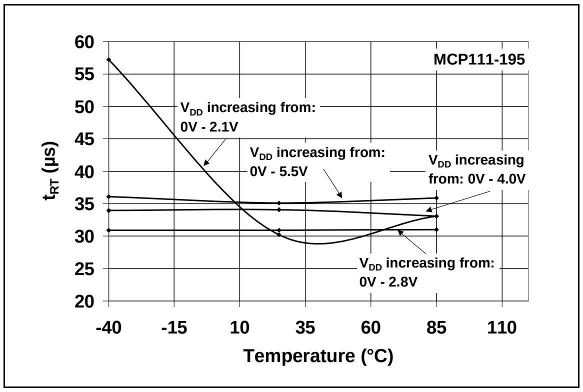


FIGURE 2-25: *t_{RT} vs. Temperature (**MCP111-195**).*

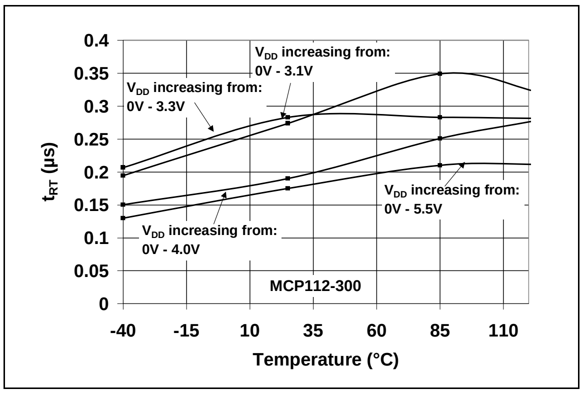


FIGURE 2-26: *t_{RT} vs. Temperature (**MCP112-300**).*

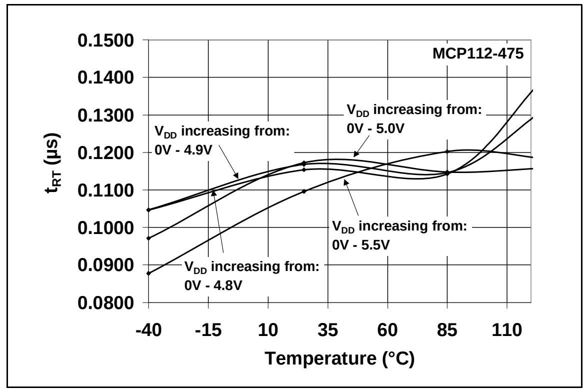


FIGURE 2-27: *t_{RT} vs. Temperature (**MCP112-475**).*

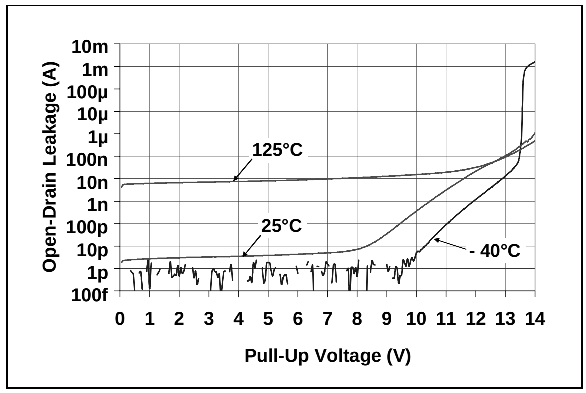


FIGURE 2-28: *Open-Drain Leakage Current vs. Voltage Applied to V_{OUT} Pin (**MCP111-195**).*

3.0 PIN DESCRIPTION

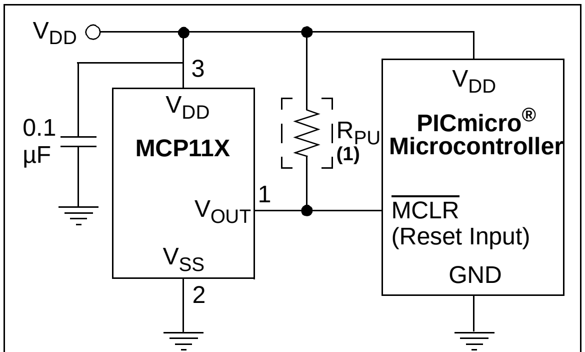
The descriptions of the pins are listed in Table 3-1.

TABLE 3-1: PIN FUNCTION TABLE

Pin No.			Symbol	Function
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	2	3	V_{SS}	Ground reference
3	3	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 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 $V_{TRIP} + V_{HYS}$.

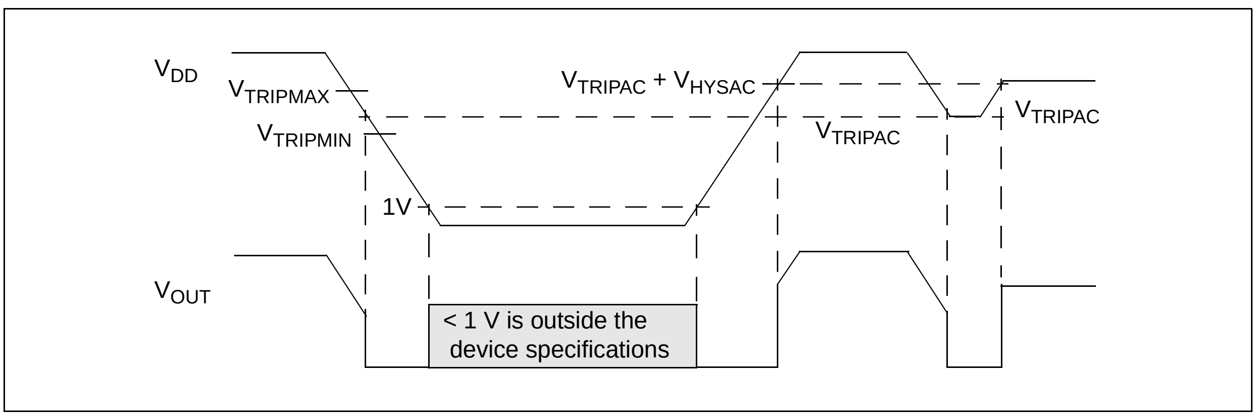


FIGURE 4-2: *V_{OUT} Operation as Determined by the V_{TRIP} and V_{HYS}.*

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

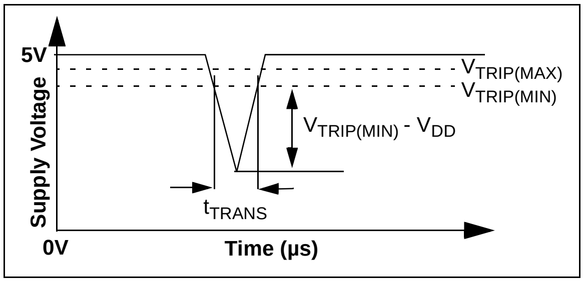


FIGURE 4-3: *Example of Typical Transient Duration Waveform.*

4.3 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 PICmicro® Microcontroller ICSP™ Applications (MCP111 only)

Figure 4-4 shows the typical application circuit for using the MCP111 for voltage supervisory function when the PICmicro microcontroller will be programmed via the In-Circuit Serial Programming™ (ICSP) feature. Additional information is available in TB087, *"Using Voltage Supervisors with PICmicro® 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 kΩ resistor.

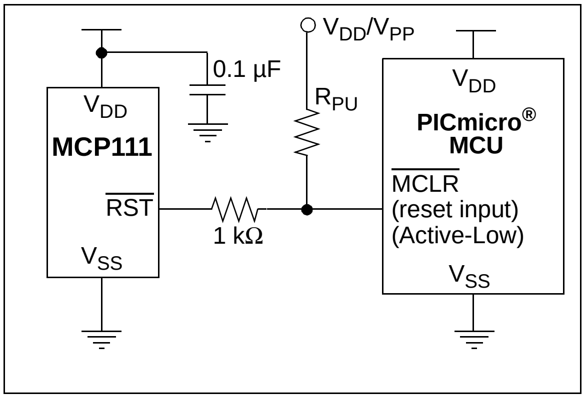
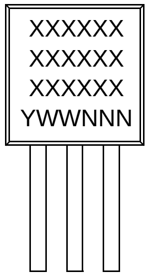


FIGURE 4-4: *Typical Application Circuit for PICmicro® Microcontroller with the ICSP™ feature.*

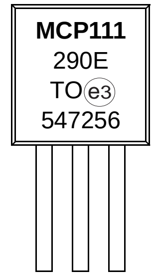
5.0 PACKAGING INFORMATION

5.1 Package Marking Information

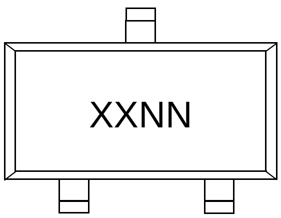
3-Lead TO-92



Example:



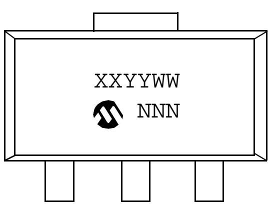
3-Pin SOT-23



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

3-Pin SOT-89



Example:

Part Number	SOT-89	Part Number	SOT-89
MCP111T-195I/MB	MP	**MCP112T-195I/MB**	MR
MCP111T-240EMB	MQ	**MCP112T-240EMB**	MS
MCP111T-270E/MB	MG	**MCP112T-270E/MB**	MA
MCP111T-290E/MB	NH	**MCP112T-290E/MB**	MB
MCP111T-300E/MB	MJ	**MCP112T-300E/MB**	MC
MCP111T-315E/MB	MK	**MCP112T-315E/MB**	MD
MCP111T-450E/MB	ML	**MCP112T-450E/MB**	ME
MCP111T-475E/MB	MM	**MCP112T-475E/MB**	MF

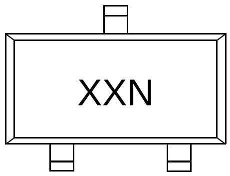
Legend:

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.

Package Marking Information (Continued)

3-Pin SC-70

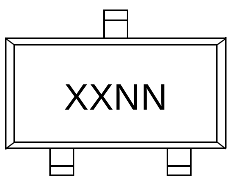


Top Side

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

OR

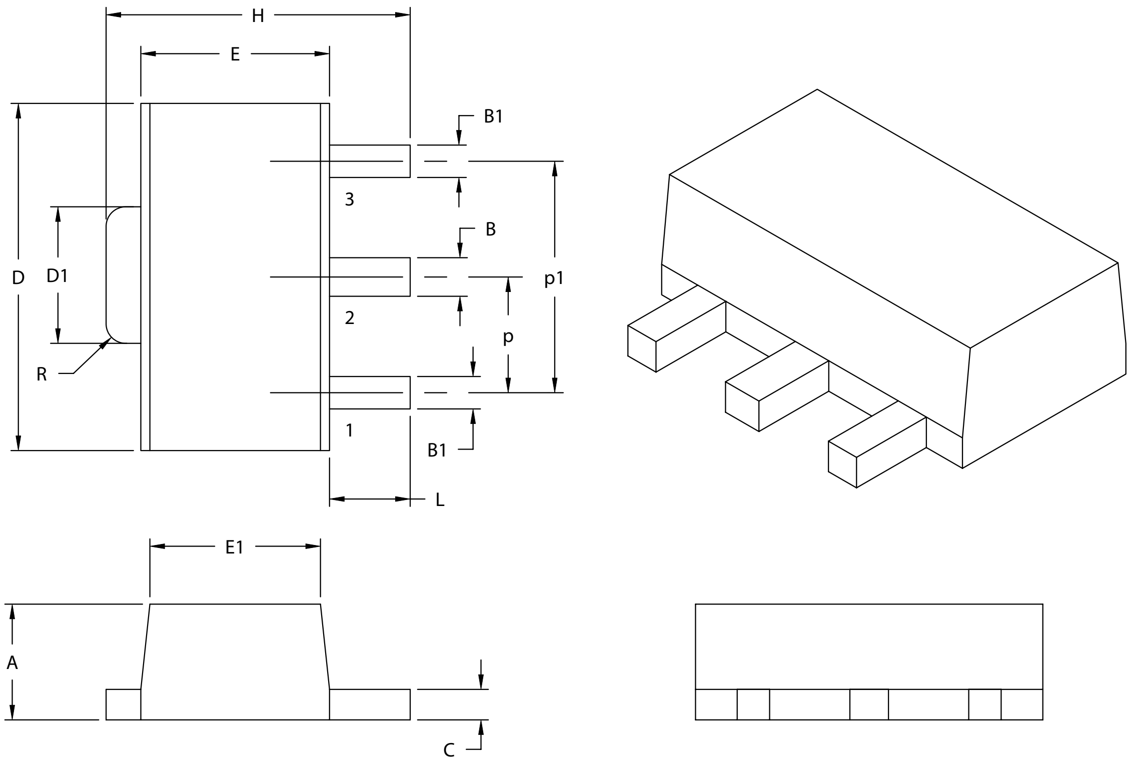


Top Side

Example:

Part Number	SC-70	Part Number	SC-70
MCP111T-195I/LB	EPNN	**MCP112T-195I/LB**	ERNN
MCP111T-240E/LB	EQNN	**MCP112T-240E/LB**	ESNN
MCP111T-270E/LB	EGNN	**MCP112T-270E/LB**	EANN
MCP111T-290E/LB	EHNN	**MCP112T-290E/LB**	EBNN
MCP111T-300E/LB	EJNN	**MCP112T-300E/LB**	ECNN
MCP111T-315E/LB	EKNN	**MCP112T-315E/LB**	EDNN
MCP111T-450E/LB	ELNN	**MCP112T-450E/LB**	EENN
MCP111T-475E/LB	EMNN	**MCP112T-475E/LB**	EFNN

3-Lead Plastic Small Outline Transistor (MB) (SOT89)



Units		INCHES		MILLIMETERS*	
Dimension Limits		MIN	MAX	MIN	MAX
Pitch	p	.059 BSC		1.50 BSC	
Outside lead pitch (basic)	p1	.118 BSC		3.00 BSC	
Overall Height	A	.055	.063	1.40	1.60
Overall Width	H	.155	.167	3.94	4.25
Molded Package Width at Base	E	.090	.102	2.29	2.60
Molded Package Width at Top	E1	.084	.090	2.13	2.29
Overall Length	D	.173	.181	4.40	4.60
Tab Length	D1	.064	.072	1.62	1.83
Tab Corner Radii	R	.010		0.254	
Foot Length	L	.035	.047	0.89	1.20
Lead Thickness	c	.014	.017	0.35	0.44
Lead 2 Width	B	.017	.022	0.43	0.56
Leads 1 & 3 Width	B1	.014	.019	0.36	0.48

*Controlling Parameter

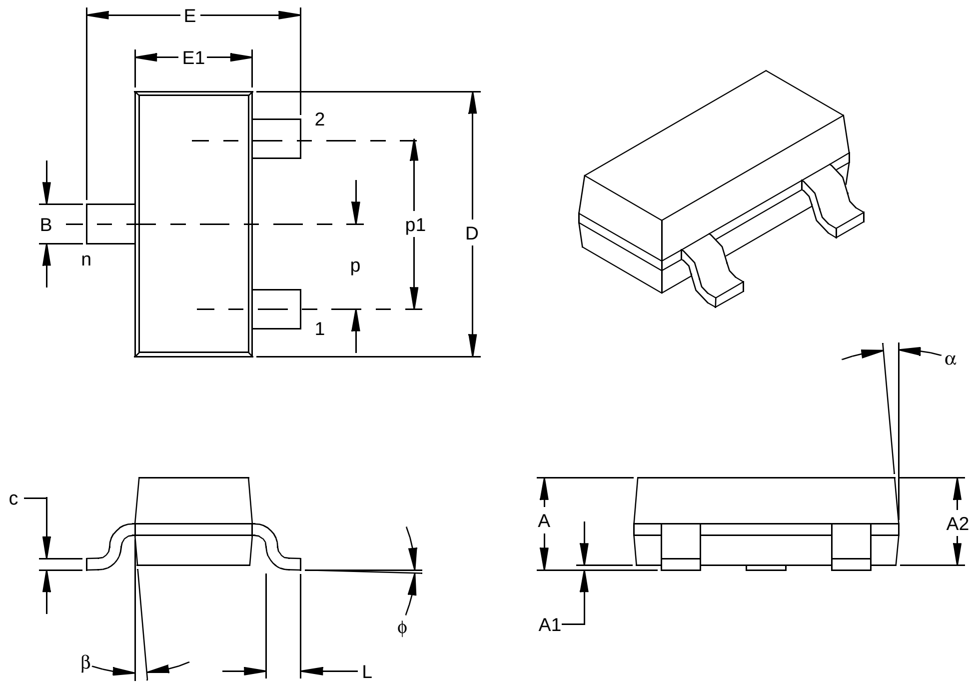
Notes:

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

JEDEC Equivalent: TO-243

Drawing No. C04-29 Revised 07-24-03

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

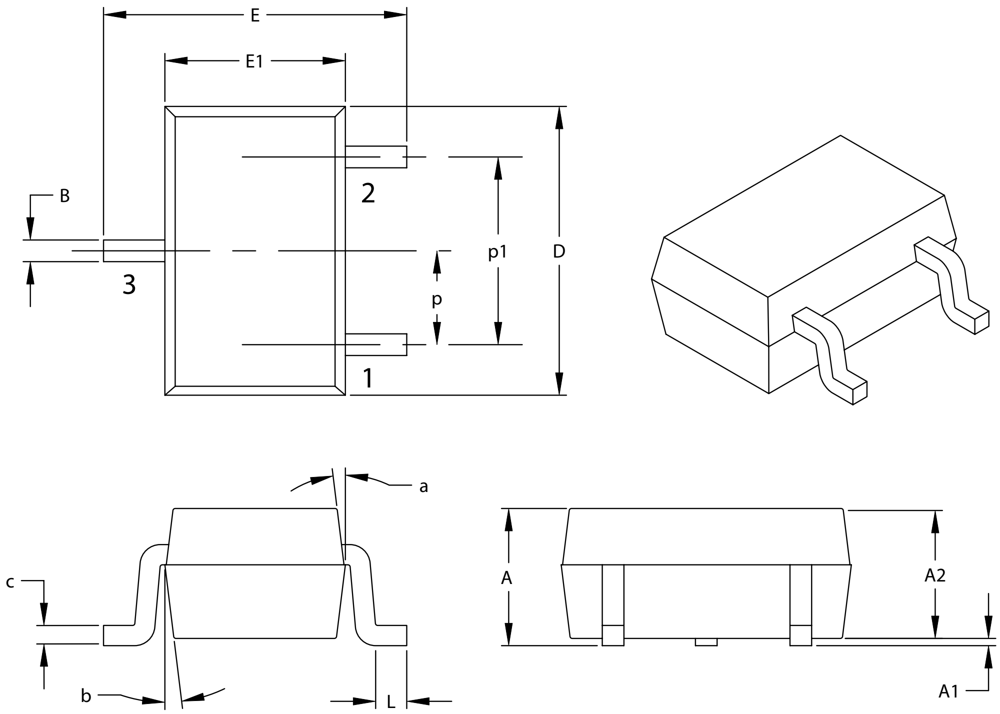


Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		3			3	
Pitch	p		.038			0.96	
Outside lead pitch (basic)	p1		.076			1.92	
Overall Height	A	.035	.040	.044	0.89	1.01	1.12
Molded Package Thickness	A2	.035	.037	.040	0.88	0.95	1.02
Standoff §	A1	.000	.002	.004	0.01	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

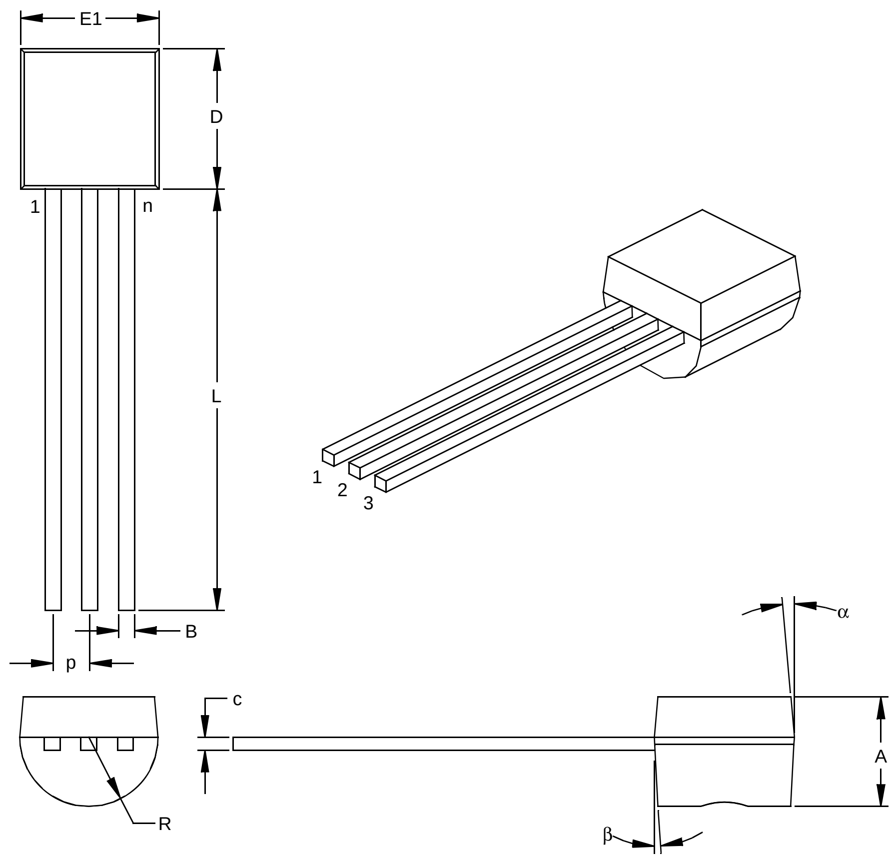
Notes:

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)

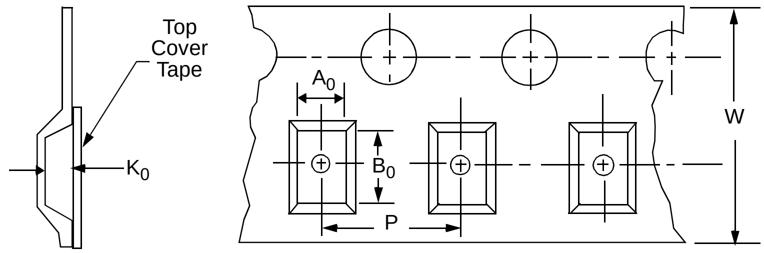
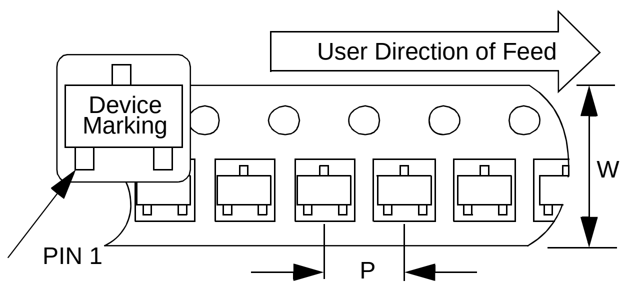


TABLE 1: CARRIER TAPE/CAVITY DIMENSIONS

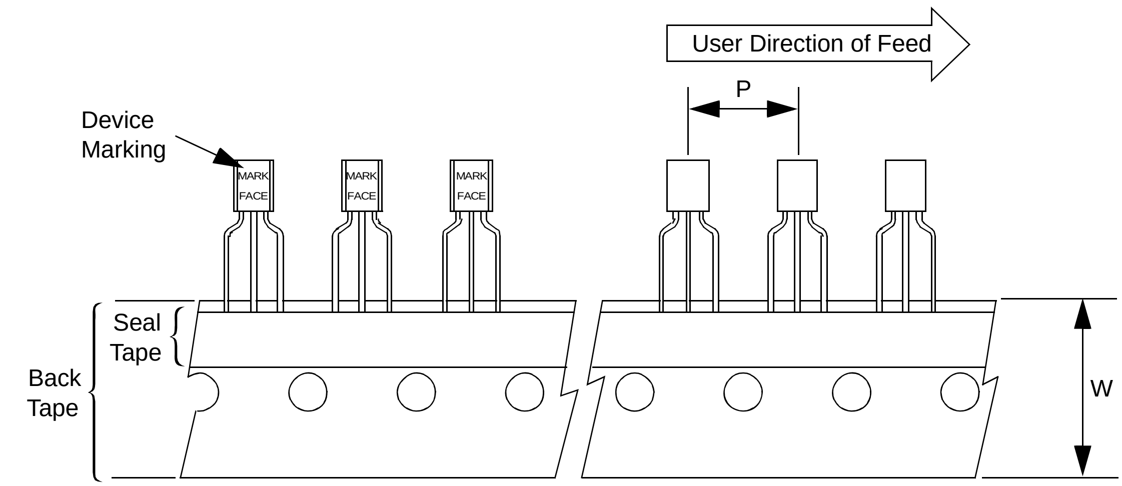
Case Outline	Package Type		Carrier Dimensions		Cavity Dimensions			Output Quantity Units	Reel Diameter in mm
			W mm	P mm	A0 mm	B0 mm	K0 mm		
TT	SOT-23B	3L	8	4	3.15	2.77	1.22	3000	180
LB	SC-70	3L	8	4	2.4	2.4	1.19	3000	180

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



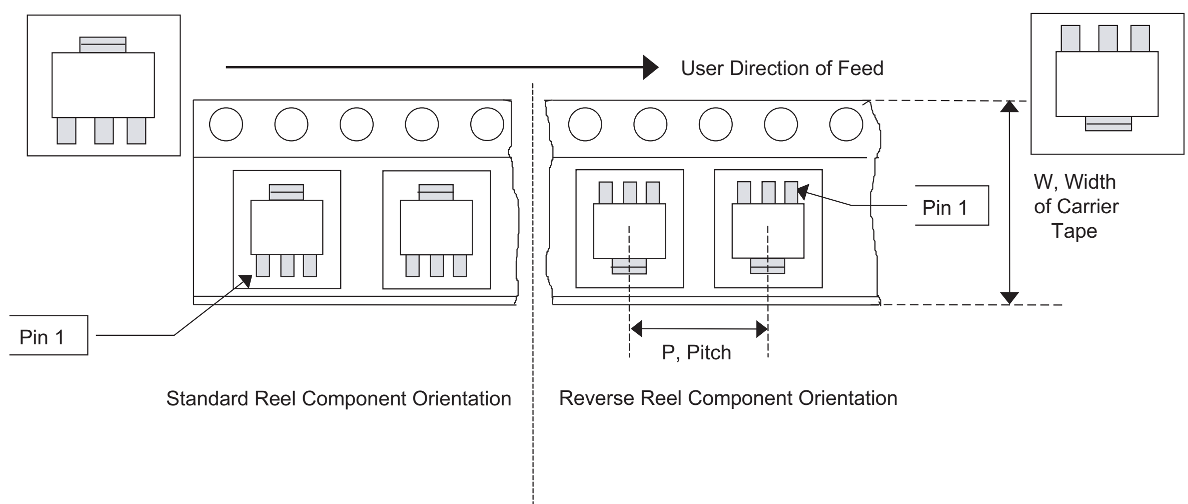
Standard Reel Component Orientation

FIGURE 5-3: TO-92 DEVICES



Note: Bent leads are for Tape and Reel only.

FIGURE 5-4: SOT-89 DEVICES



APPENDIX A: REVISION HISTORY

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 PICmicro® Microcontroller ICSP™ Applications (MCP111 only)"** on using the MCP111 in PICmicro 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.

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:	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.

NOTES:

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Fax: 86-10-8528-2104

China - Chengdu
Tel: 86-28-8676-6200
Fax: 86-28-8676-6599

China - Fuzhou
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Fax: 86-591-8750-3521

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Fax: 852-2401-3431

China - Shanghai
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Fax: 86-21-5407-5066

China - Shenyang
Tel: 86-24-2334-2829
Fax: 86-24-2334-2393

China - Shenzhen
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Fax: 86-757-2839-5571

China - Qingdao
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Fax: 86-532-502-7205

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Fax: 91-80-2229-0062

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Tel: 91-11-5160-8631
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Fax: 81-45-471-6122

Korea - Seoul
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Fax: 82-2-558-5932 or
82-2-558-5934

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Fax:011-604-646-5086

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Fax: 011-632-634-9069

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