MICROCHIP

MCP120/130

Microcontroller Supervisory Circuit with Open Drain Output

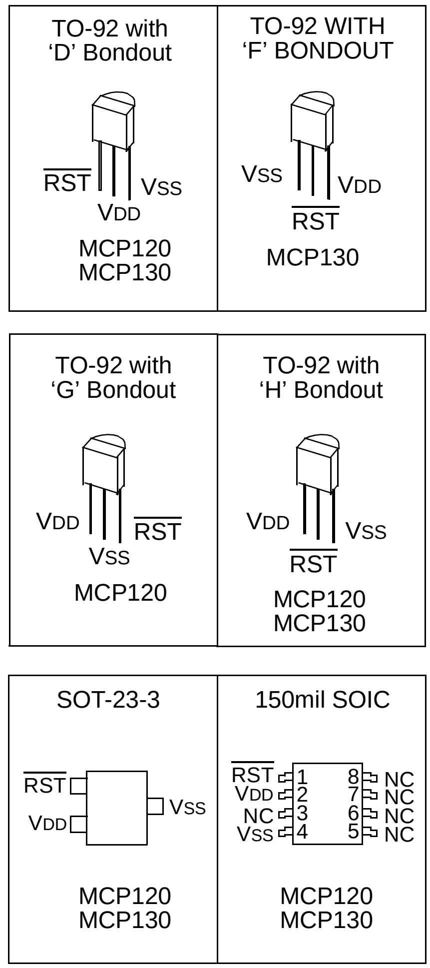
FEATURES

- Holds microcontroller in reset until supply voltage reaches stable operating level
- Resets microcontroller during power loss
- Precision monitoring of 3V, 3.3V and 5V systems
- 7 voltage trip points available
- Active low $\overline{\text{RESET}}$ pin
- Open drain output
- Internal pull-up resistor (5 kΩ) for MCP130
- Holds $\overline{\text{RESET}}$ for 350 ms (typical)
- $\overline{\text{RESET}}$ to V_{CC} = 1.0V
- Accuracy of ±125 mV for 5V systems and ±75 mV for 3V systems over temperature
- 45 µA typical operating current
- Temperature range:
  - Industrial (I): -40°C to +85°C

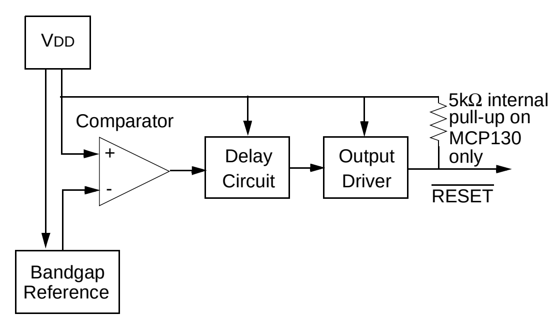
DESCRIPTION

The Microchip Technology Inc. MCP120/130 is a voltage supervisory device designed to keep a microcontroller in reset until the system voltage has reached the proper level and stabilized. It also operates as protection from brown-out conditions when the supply voltage drops below a safe operating level. Both devices are available with a choice of seven different trip voltages and both have open drain outputs. The MCP130 has an internal 5 kΩ pullup resistor. Both devices have active low $\overline{\text{RESET}}$ pins. The MCP120/130 will assert the $\overline{\text{RESET}}$ signal whenever the voltage on the V_{DD} pin is below the trip-point voltage.

PACKAGES



BLOCK DIAGRAM



1.0 ELECTRICAL CHARACTERISTICS

1.1 Maximum Ratings*

V_{DD} 7.0V
All inputs and outputs w.r.t. V_{SS} ..... -0.6V to V_{DD} +1.0V
Storage temperature .... -65°C to +150°C
Ambient temp. with power applied ..... -65°C to +125°C
ESD protection on all pins .... ≥ 2 kV

***Notice:** Stresses above those listed under “Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

DC AND AC CHARACTERISTICS

All parameters apply at the specified temp and voltage ranges unless otherwise noted.		V_{DD} = 1.0 - 5.5V Industrial (I): -40°C to +85°C					
Parameter		**Symbol**	**Min.**	**Typ.**	**Max.**	**Units**	**Test Conditions**
Operating Voltage Range		V_{DD}	1.0	—	5.5	V	
V_{DD} Value to $\overline{\text{RESET}}$		V_{DDMIN}	1.0	—	—	V	
Operating Current		I_{DD}	—	45	60	µA	V_{DD} = 5.5V (no load)
V_{DD} Trip Point	MCP1X0-270 MCP1X0-300 MCP1X0-315 MCP1X0-450 MCP1X0-460 MCP1X0-475 MCP1X0-485	V_{TRIP}	2.55 2.85 3.0 4.25 4.35 4.50 4.60	2.625 2.925 3.075 4.375 4.475 4.625 4.725	2.7 3.0 3.15 4.50 4.60 4.75 4.85	V	
$\overline{\text{RESET}}$ Low Level Output Voltage	MCP1X0-270 MCP1X0-300 MCP1X0-315	V_{OL}	—	—	0.4	V	I_{OL} = 3.2 mA, V_{DD} = $V_{TRIPMIN}$
	MCP1X0-450 MCP1X0-460 MCP1X0-475 MCP1X0-485		—	—	0.6		I_{OL} = 8.5 mA, V_{DD} = $V_{TRIPMIN}$
$\overline{\text{RESET}}$ High Level Output Voltage (MCP130 Only)	MCP130-xxx (All V_{TRIP} Points)	V_{OH}	V_{DD}-0.7	—	—	V	I_{OH} = 50 µA, V_{DD} > $V_{TRIPMAX}$
Pull-up Resistor (MCP130 Only)			—	5	—	kΩ	
Output Leakage (MCP120 Only)			—	1	—	µA	
Threshold Hysteresis		V_{HYS}	—	50	—	mV	
V_{DD} Detect to $\overline{\text{RESET}}$ Inactive		t_{RPU}	150	350	700	ms	
V_{DD} Detect to $\overline{\text{RESET}}$		t_{RPD}	—	10	—	µs	V_{DD} ramped from $V_{TRIPMAX}$ + 250 mV down to $V_{TRIPMIN}$ - 250 mV
Note: Typical values are for 25°C and V_{DD} = 5.0V							

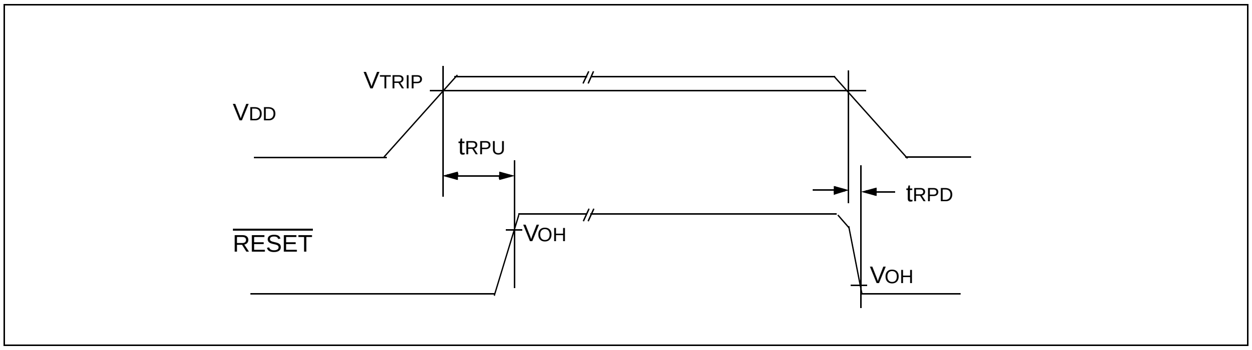


Figure 1-1: MCP120/130 Timing Diagram

2.0 APPLICATIONS INFORMATION

2.1 The Need for Supervisory Circuits

For many of today's microcontroller applications, care must be taken to prevent low power conditions that can cause many different system problems. The most common causes are brown-out conditions where the system supply drops below the operating level momentarily, and the second, is when a slowly decaying power supply causes the microcontroller to begin executing instructions without enough voltage to sustain SRAM and producing indeterminate results.

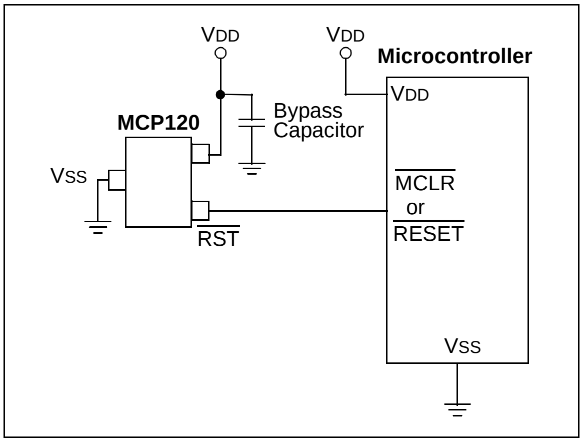


Figure 2-1: *Typical Application*

2.2 Negative Going V_{DD} Transients

Many system designers implementing POR circuits are concerned about the minimum pulse width required to cause a reset. Figure 2-2 shows typical transient voltage below the trip point (V_{TRIP} - V_{DD}) vs. transient duration. It shows that the farther below the trip point the transient pulse goes, the duration of the pulse required to cause a reset gets shorter. A 0.1 µF bypass cap mounted as close as possible to the V_{DD} pin provides additional transient immunity.

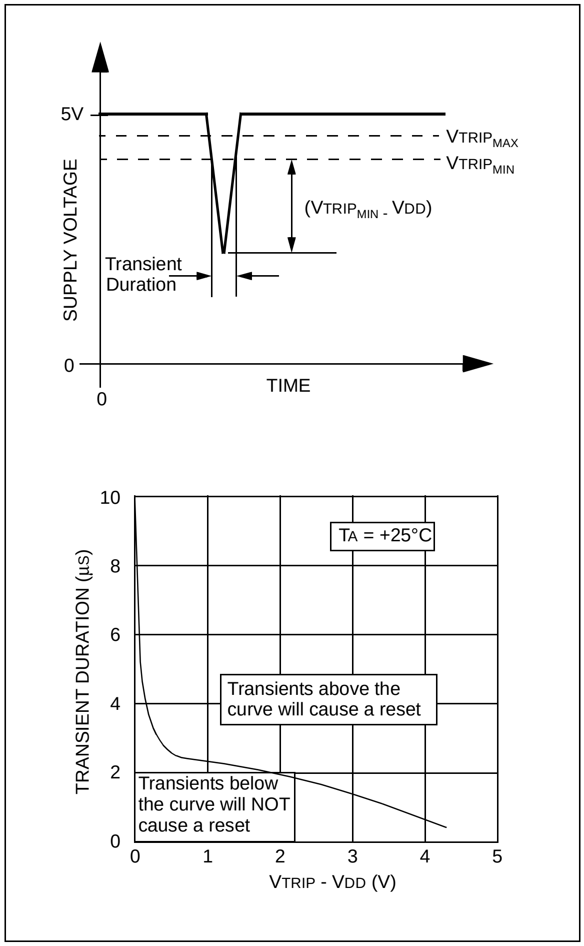


Figure 2-2: *Typical Transient Response*

2.3 Effect of Temperature on Timeout Period (tRPU)

The timeout period (tRPU) determines how long the device remains in the reset condition. This is controlled by an internal RC timer and is effected by both VDD and temperature. The graph shown in Figure 2-3 shows typical response for different VDD values and temperatures.

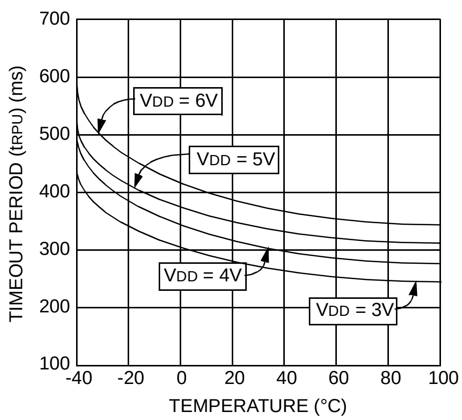


Figure 2-3: *tRPU vs. Temperature*

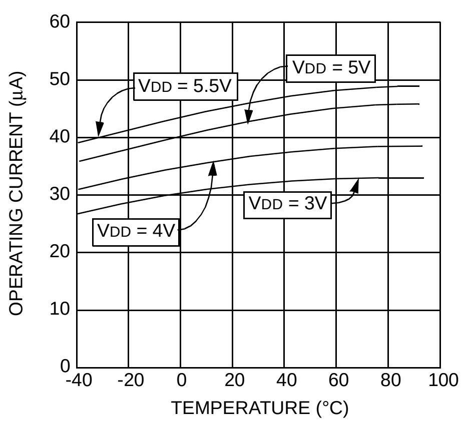
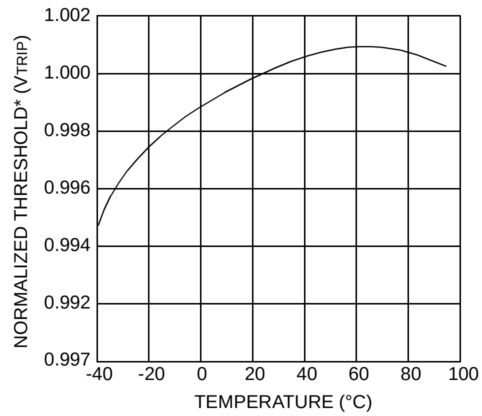


Figure 2-4: *IDD vs. Temperature*



* Multiply value at 25°C by this factor to determine the value at temperature

Figure 2-5: *Normalized VTRIP vs. Temperature*

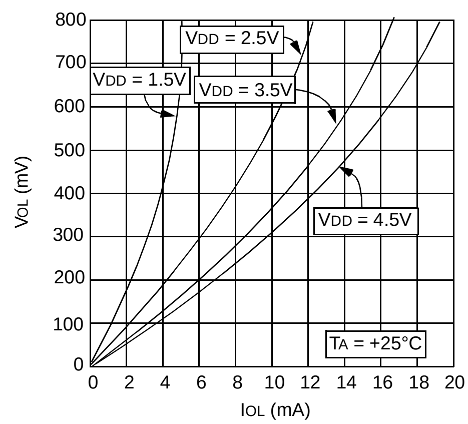
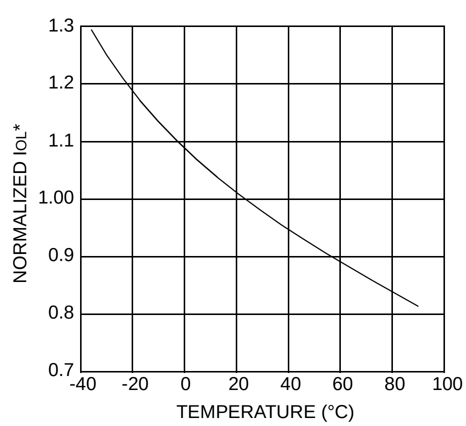


Figure 2-6: *VOL vs. IOL*



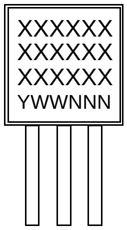
* Multiply value at 25°C by this factor to determine the value at temperature

Figure 2-7: *Normalized IOL vs. Temperature*

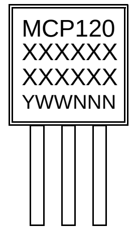
3.0 PACKAGING INFORMATION

3.1 Package Marking Information

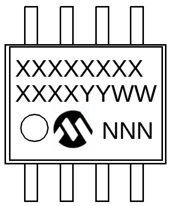
3-Lead Plastic Transistor Outline (TO-92)



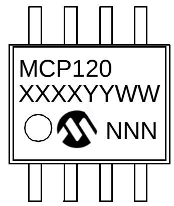
Example:



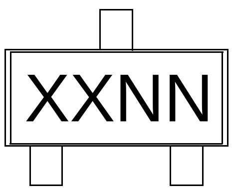
8-Lead Plastic Small Outline (SOIC)



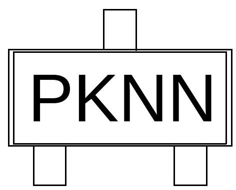
Example:



3-Lead Plastic Small Outline Transistor (SOT23)



Example:



SOT23 PARTS LABELING:

The table below identifies the first 2 characters (XX) in the 4-character field (XXNN) for marking of the 3-Lead SOT23 package.

Mark	Part Number	Mark	Part Number
SJ	MCP120T-270I/TT	PJ	MCP130T-270I/TT
SK	MCP120T-300I/TT	PK	MCP130T-300I/TT
SL	MCP120T-315I/TT	PL	MCP130T-315I/TT
SM	MCP120T-450I/TT	PM	MCP130T-450I/TT
SN	MCP120T-460I/TT	PN	MCP130T-460I/TT
SO	MCP120T-475I/TT	PO	MCP130T-475I/TT
SP	MCP120T-485I/TT	PP	MCP130T-485I/TT

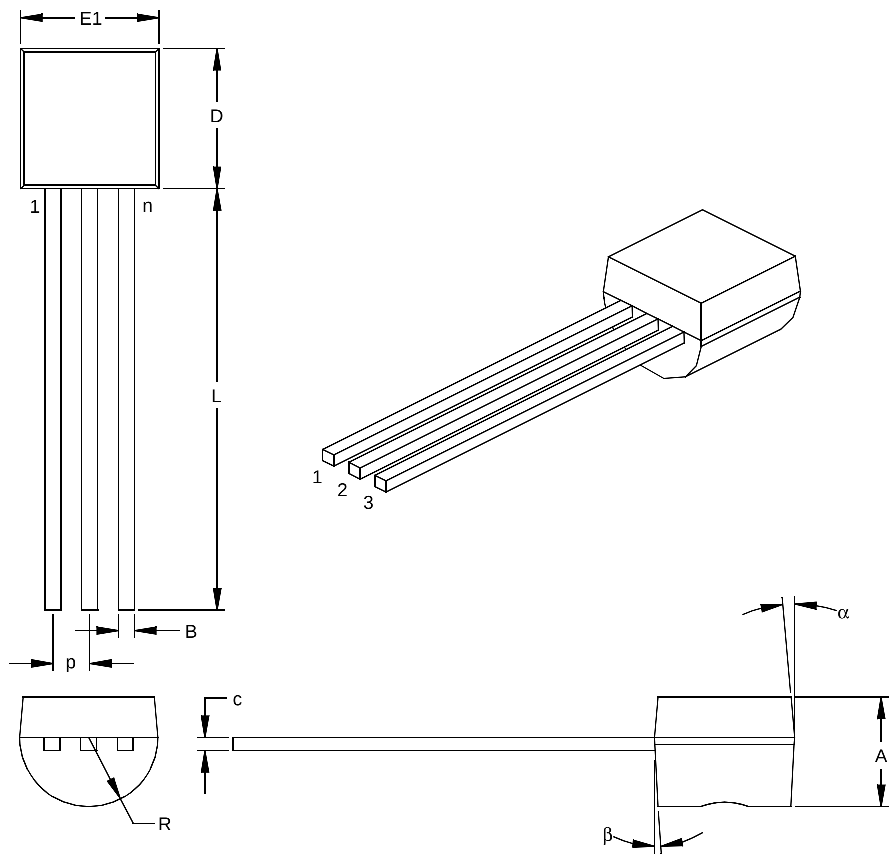
Legend:		
	XX...X	Customer specific information*
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code

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

* Standard OTP marking consists of Microchip part number, year code, week code, and traceability code. For OTP marking beyond this, certain price adders apply. Please check with your Microchip Sales Office. For QTP devices, any special marking adders are included in QTP price.

3.2 Package Detail Information

3-Lead Plastic 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

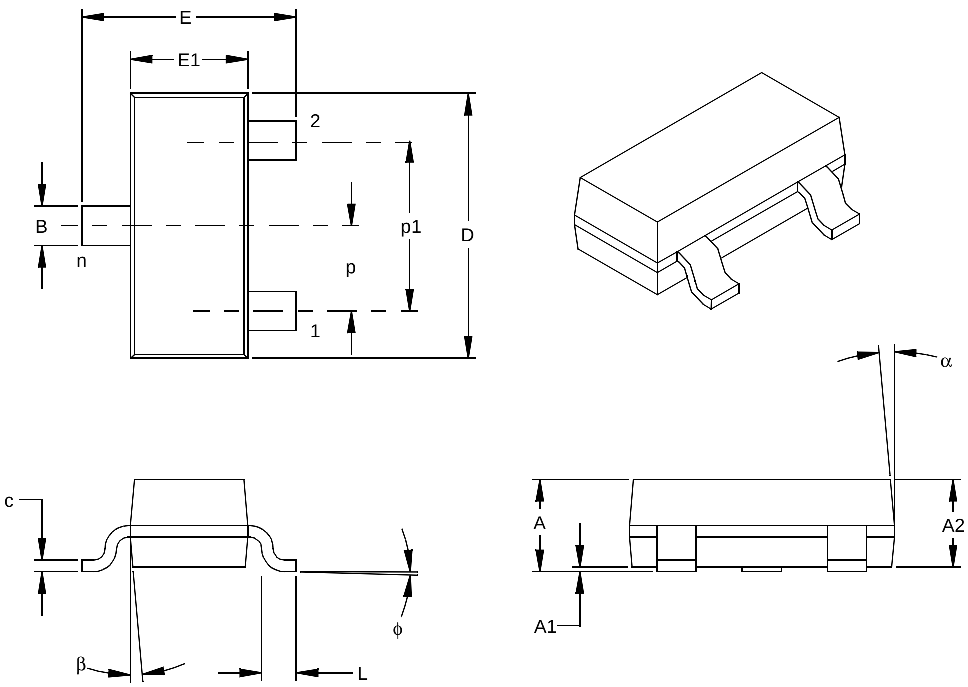
Notes:

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

3-Lead Plastic Small Outline Transistor (TT) (SOT23)

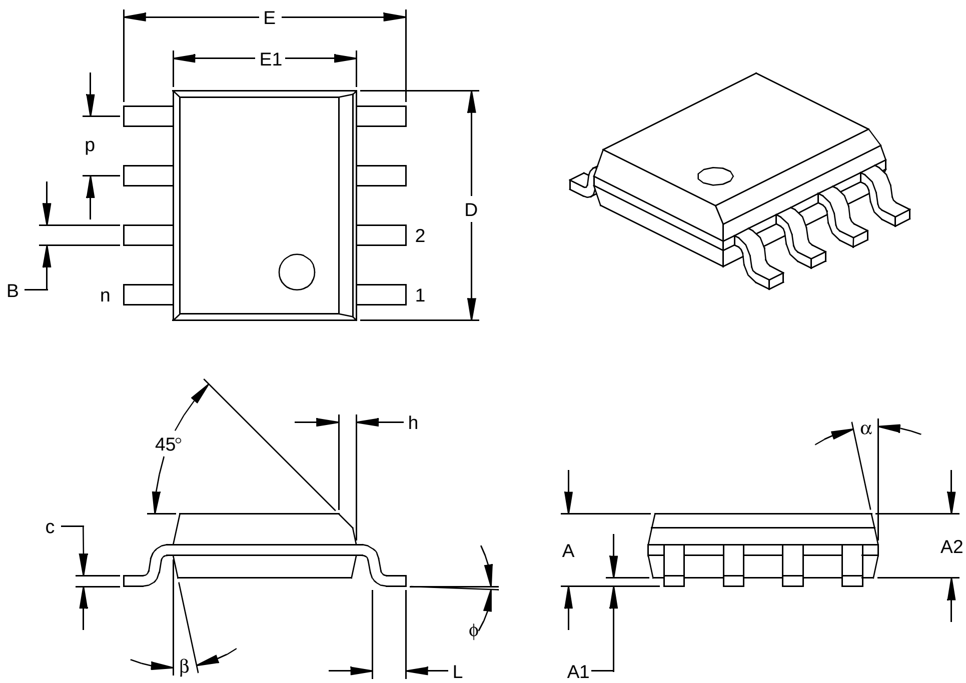


		Units	INCHES*			MILLIMETERS		
		Dimension Limits	MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n			3			3	
Pitch	p			.038			0.96	
Outside lead pitch (basic)	p1			.076			1.92	
Overall Height	A		.035	.040	.044	0.89	1.01	1.12
Molded Package Thickness	A2		.035	.037	.040	0.88	0.95	1.02
Standoff §	A1		.000	.002	.004	0.01	0.06	0.10
Overall Width	E		.083	.093	.104	2.10	2.37	2.64
Molded Package Width	E1		.047	.051	.055	1.20	1.30	1.40
Overall Length	D		.110	.115	.120	2.80	2.92	3.04
Foot Length	L		.014	.018	.022	0.35	0.45	0.55
Foot Angle	φ		0	5	10	0	5	10
Lead Thickness	c		.004	.006	.007	0.09	0.14	0.18
Lead Width	B		.015	.017	.020	0.37	0.44	0.51
Mold Draft Angle Top	α		0	5	10	0	5	10
Mold Draft Angle Bottom	β		0	5	10	0	5	10

* Controlling Parameter
§ Significant Characteristic

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

8-Lead Plastic Small Outline (SN) – Narrow, 150 mil (SOIC



Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		8			8	
Pitch	p		.050			1.27	
Overall Height	A	.053	.061	.069	1.35	1.55	1.75
Molded Package Thickness	A2	.052	.056	.061	1.32	1.42	1.55
Standoff §	A1	.004	.007	.010	0.10	0.18	0.25
Overall Width	E	.228	.237	.244	5.79	6.02	6.20
Molded Package Width	E1	.146	.154	.157	3.71	3.91	3.99
Overall Length	D	.189	.193	.197	4.80	4.90	5.00
Chamfer Distance	h	.010	.015	.020	0.25	0.38	0.51
Foot Length	L	.019	.025	.030	0.48	0.62	0.76
Foot Angle	φ	0	4	8	0	4	8
Lead Thickness	c	.008	.009	.010	0.20	0.23	0.25
Lead Width	B	.013	.017	.020	0.33	0.42	0.51
Mold Draft Angle Top	α	0	12	15	0	12	15
Mold Draft Angle Bottom	β	0	12	15	0	12	15

* 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: MS-012
Drawing No. C04-057

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Device: **MCP120/130**   Literature Number: **DS11184D**

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NOTES:

NOTES:

PRODUCT IDENTIFICATION SYSTEM

To order or to obtain information (e.g., on pricing or delivery), please refer to the factory or the listed sales offices.

PART NO.	X	X	X	/XX
Device	$\overline{\text{RESET}}$/ RESET VTRIP Voltage	Bondout Option	Temperature Range	Package

Device:	MCP120:		Supervisor circuit with open drain output
	MCP120T:		Supervisor circuit with open drain output (tape & reel)
	MCP130:		Supervisor circuit with open drain output and internal pull-up resistor
	MCP130T:		Supervisor circuit with open drain output and internal pull-up resistor (tape & reel)
$\overline{\text{RESET}}$/RESET VTRIP Voltage	270	=	$2.55 \le V_{TRIP} \le 2.70$
	300	=	$2.85 \le V_{TRIP} \le 3.00$
	315	=	$3.00 \le V_{TRIP} \le 3.15$
	450	=	$4.25 \le V_{TRIP} \le 4.50$
	460	=	$4.35 \le V_{TRIP} \le 4.60$
	475	=	$4.50 \le V_{TRIP} \le 4.75$
	485	=	$4.60 \le V_{TRIP} \le 4.85$
Bondout Option: (TO-92 Only)	D	=	D Bond Option (see bond option chart)
	F	=	F Bond Option
	G	=	G Bond Option
	H	=	H Bond Option
Temperature Range:	I	=	-40°C to +85°C (only offered in I)
Package:	SN	=	SOIC (8-lead, 150 mil body)
	TO	=	TO-92 (3-lead) [offered in bags only]
	TT	=	SOT-23 (3-lead) [offered in tape & reel only]

Examples:

a) MCP120–270I/SN = V_{TRIP} range of 2.55V - 2.70V, Industrial Temp., SOIC package

b) MCP120–300DI/TO = V_{TRIP} range of 2.85V - 3.00V, Bonding Option D, Industrial Temp., TO-92 package

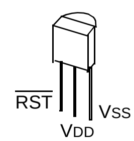
c) MCP120T–315I/TT = V_{TRIP} range of 3.00V - 3.15V, Industrial Temp., SOT-23 package

d) MCP130–450I/SN = V_{TRIP} range of 4.25V - 4.50V, Industrial Temp., SOIC package

e) MCP130–460FI/TO = V_{TRIP} range of 4.35V - 4.60V, Bonding Option F, Industrial Temp., TO-92 package

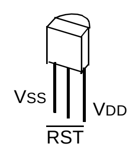
f) MCP130T–475I/TT = Tape & Reel, V_{TRIP} range of 4.50V - 4.75V, Industrial Temp., SOT-23 package

TO-92 with 'D' Bondout



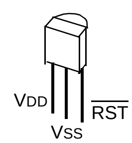
MCP120
MCP130

TO-92 with 'F' Bondout



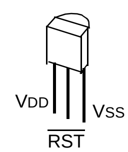
MCP130

TO-92 with 'G' Bondout



MCP120

TO-92 with 'H' Bondout



MCP120
MCP130

Sales and Support

Data Sheets
Products supported by a preliminary Data Sheet may have an errata sheet describing minor operational differences and recommended workarounds. To determine if an errata sheet exists for a particular device, please contact one of the following:

1. Your local Microchip sales office
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