

Microcontroller Supervisory Circuit with Open Drain Output

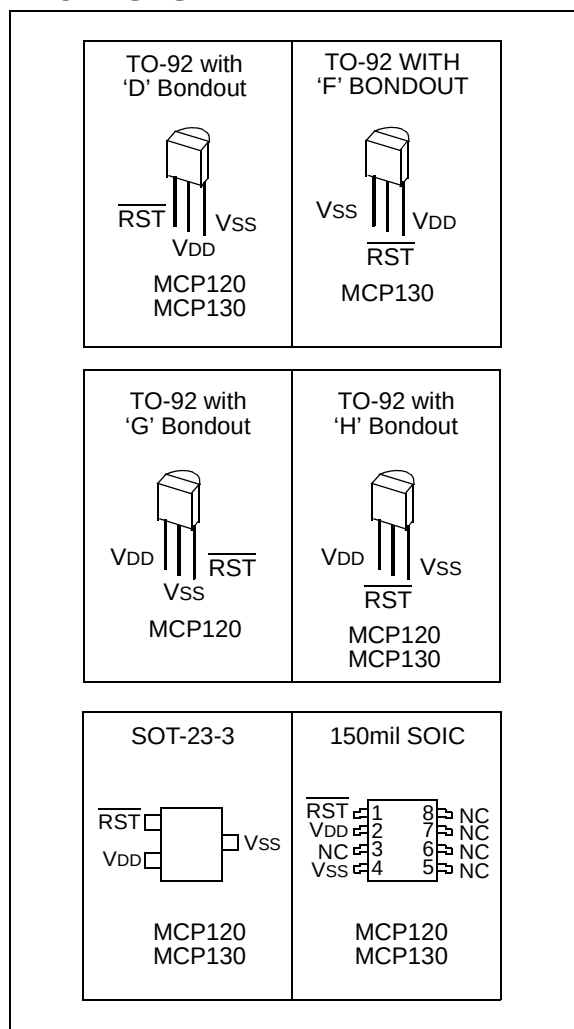
FEATURES

- 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 k Ω) 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

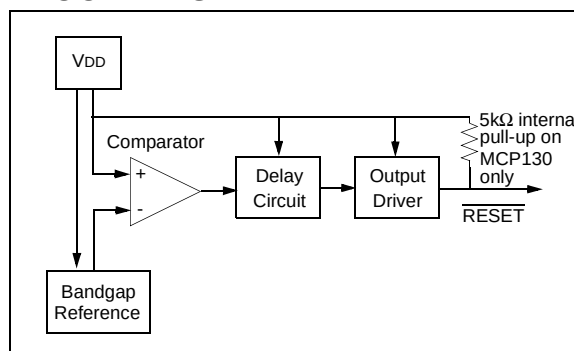
DESCRIPTION

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 k Ω 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.		VDD = 1.0 - 5.5V Industrial (I): -40°C to +85°C					
Parameter		Symbol	Min.	Typ.	Max.	Units	Test Conditions
Operating Voltage Range		VDD	1.0	—	5.5	V	
VDD Value to RESET		VDD _{MIN}	1.0	—	—	V	
Operating Current		IDD	—	45	60	μA	VDD = 5.5V (no load)
VDD Trip Point	MCP1X0-270	VTRIP	2.55	2.625	2.7	V	
	MCP1X0-300		2.85	2.925	3.0		
	MCP1X0-315		3.0	3.075	3.15		
	MCP1X0-450		4.25	4.375	4.50		
	MCP1X0-460		4.35	4.475	4.60		
	MCP1X0-475		4.50	4.625	4.75		
	MCP1X0-485		4.60	4.725	4.85		
RESET Low Level Output Voltage	MCP1X0-270 MCP1X0-300 MCP1X0-315	VOL	—	—	0.4	V	IOL = 3.2 mA, VDD = VTRIP _{MIN}
	MCP1X0-450 MCP1X0-460 MCP1X0-475 MCP1X0-485		—	—	0.6		IOL = 8.5 mA, VDD = VTRIP _{MIN}
RESET High Level Output Voltage (MCP130 Only)	MCP130-xxx (All VTRIP Points)	VOH	VDD-0.7	—	—	V	IOH = 50 μA, VDD > VTRIP _{MAX}
Pull-up Resistor (MCP130 Only)			—	5	—	kΩ	
Output Leakage (MCP120 Only)			—	1	—	μA	
Threshold Hysteresis		VHYS	—	50	—	mV	
VDD Detect to RESET Inactive		trPU	150	350	700	ms	
VDD Detect to RESET		trPD	—	10	—	μs	VDD ramped from VTRIP _{MAX} + 250 mV down to VTRIP _{MIN} - 250 mV
Note: Typical values are for 25°C and VDD = 5.0V							

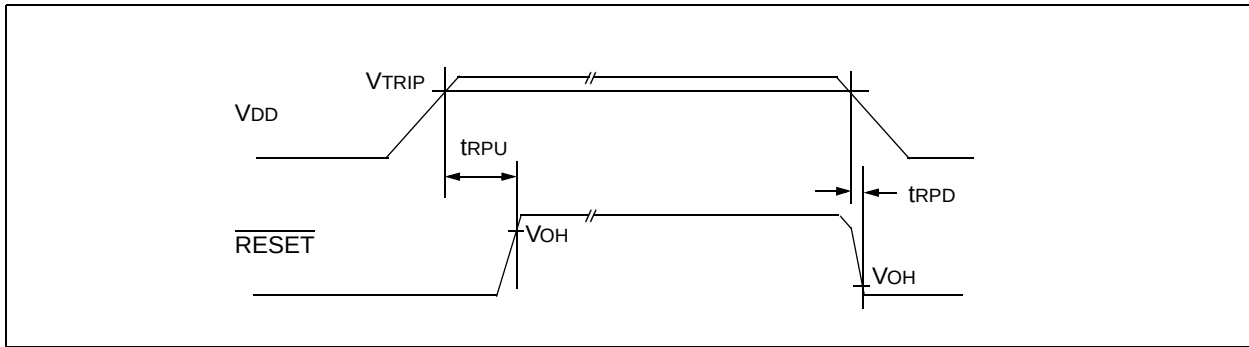


Figure 1-1: MCP120/130 Timing Diagram

MCP120/130

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.

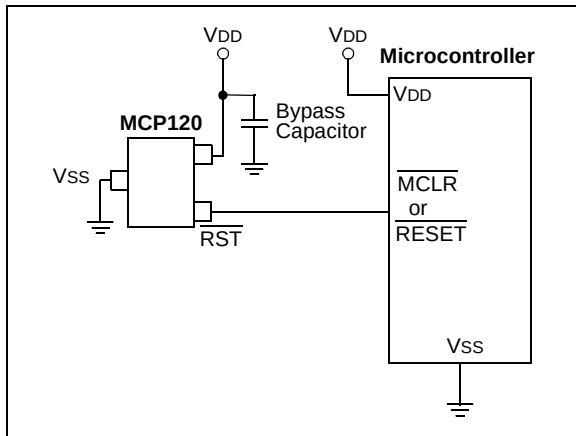


Figure 2-1: Typical Application

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 μ F bypass cap mounted as close as possible to the VDD pin provides additional transient immunity.

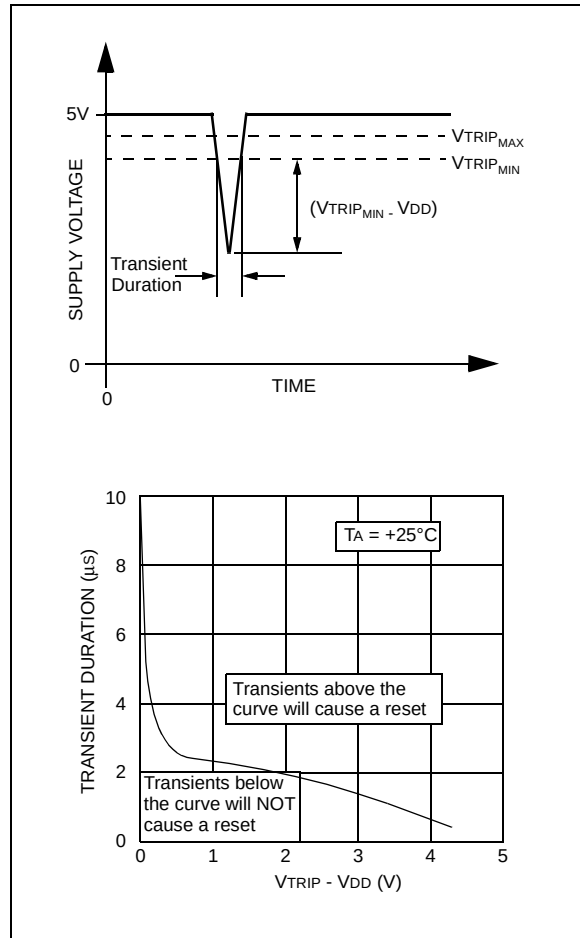


Figure 2-2: Typical Transient Response

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.

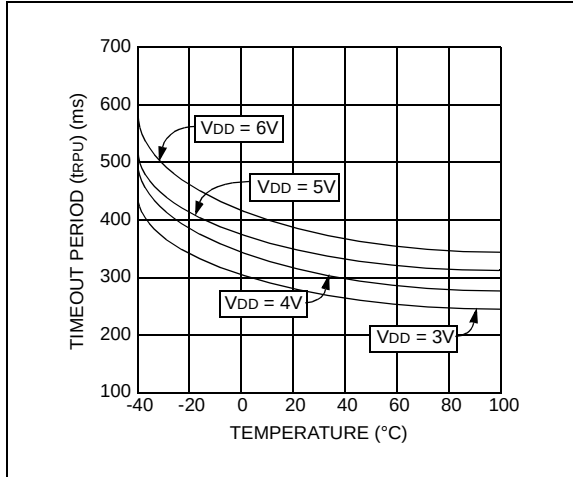


Figure 2-3: tRPU vs. Temperature

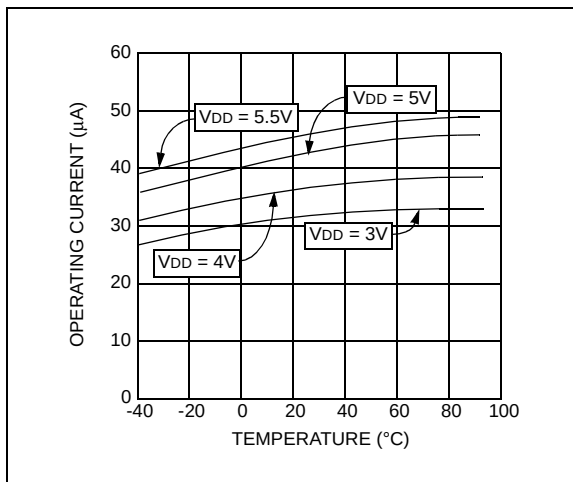


Figure 2-4: IDD vs. Temperature

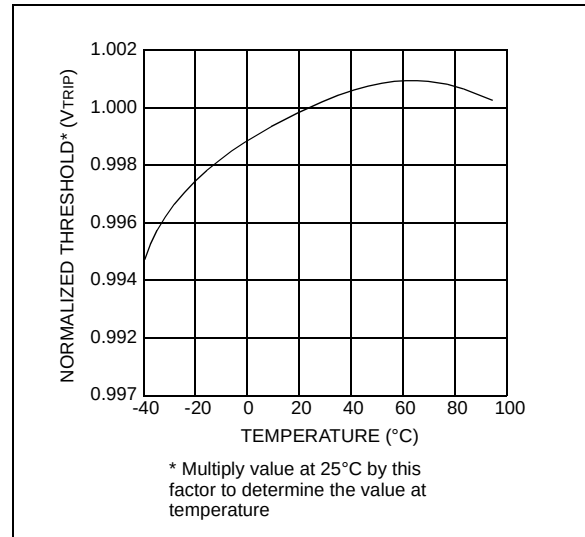


Figure 2-5: Normalized VTRIP vs. Temperature

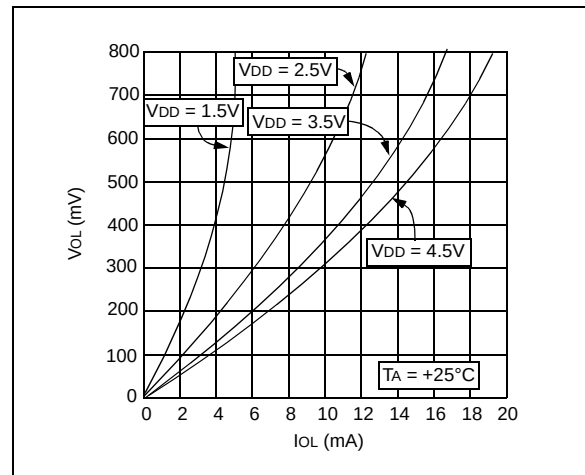


Figure 2-6: VOL vs. IOL

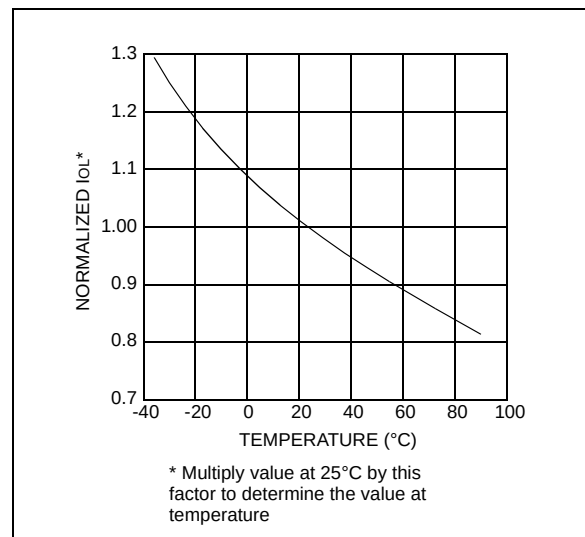


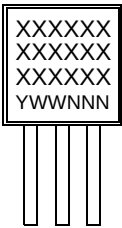
Figure 2-7: Normalized IOL vs. Temperature

MCP120/130

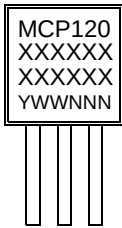
3.0 PACKAGING INFORMATION

3.1 Package Marking Information

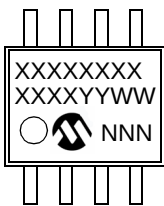
3-Lead Plastic Transistor Outline (TO-92)



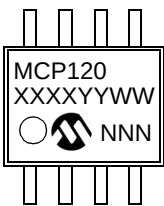
Example:



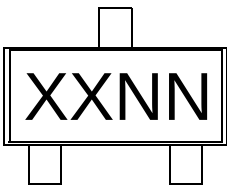
8-Lead Plastic Small Outline (SOIC)



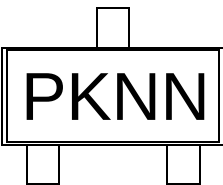
Example:



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.

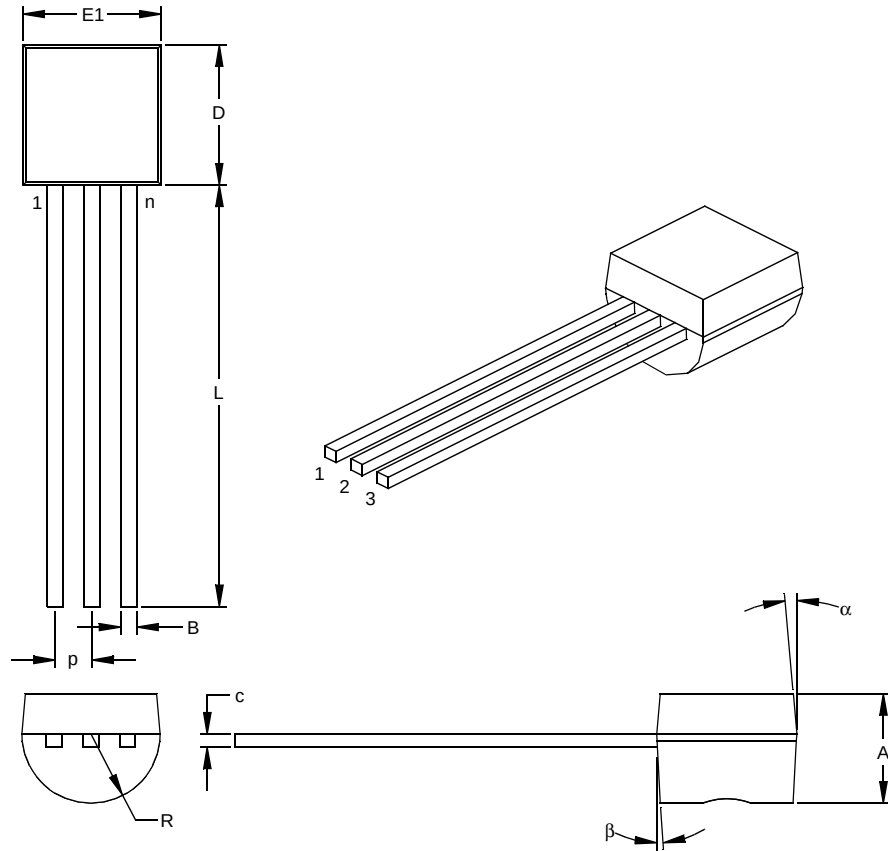
Mark	Part Number	Mark	Part Number
SJ	MCP120T-270I/TT	PJ	MCP130T-270I/TT
SK	MCP120T-300I/TT	PK	MCP130T-300I/TT
SL	MCP120T-315I/TT	PL	MCP130T-315I/TT
SM	MCP120T-450I/TT	PM	MCP130T-450I/TT
SN	MCP120T-460I/TT	PN	MCP130T-460I/TT
SO	MCP120T-475I/TT	PO	MCP130T-475I/TT
SP	MCP120T-485I/TT	PP	MCP130T-485I/TT

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

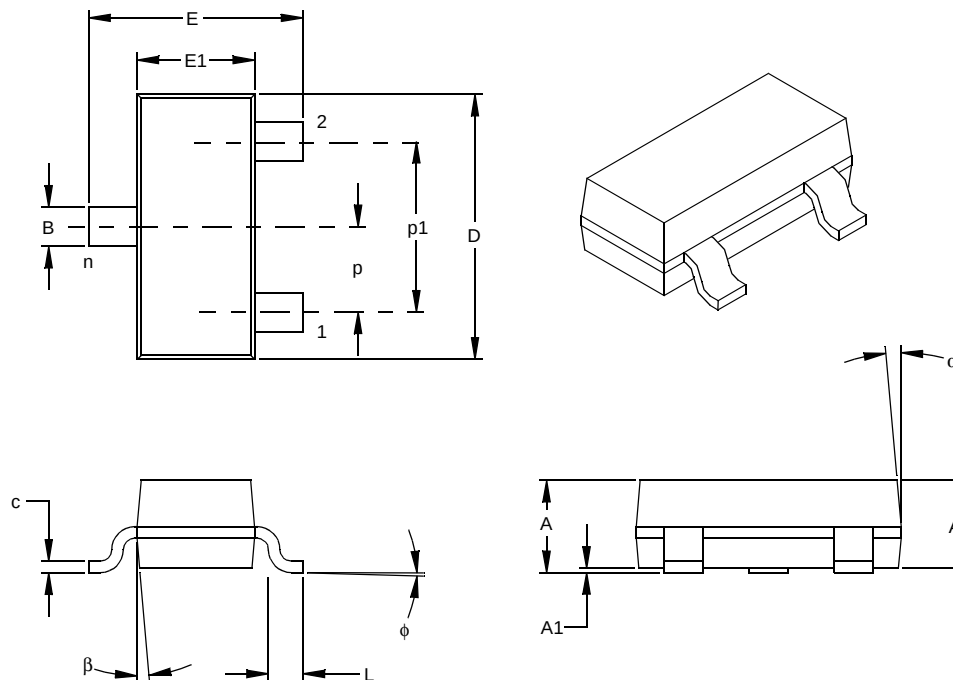
*Controlling Parameter

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

MCP120/130

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

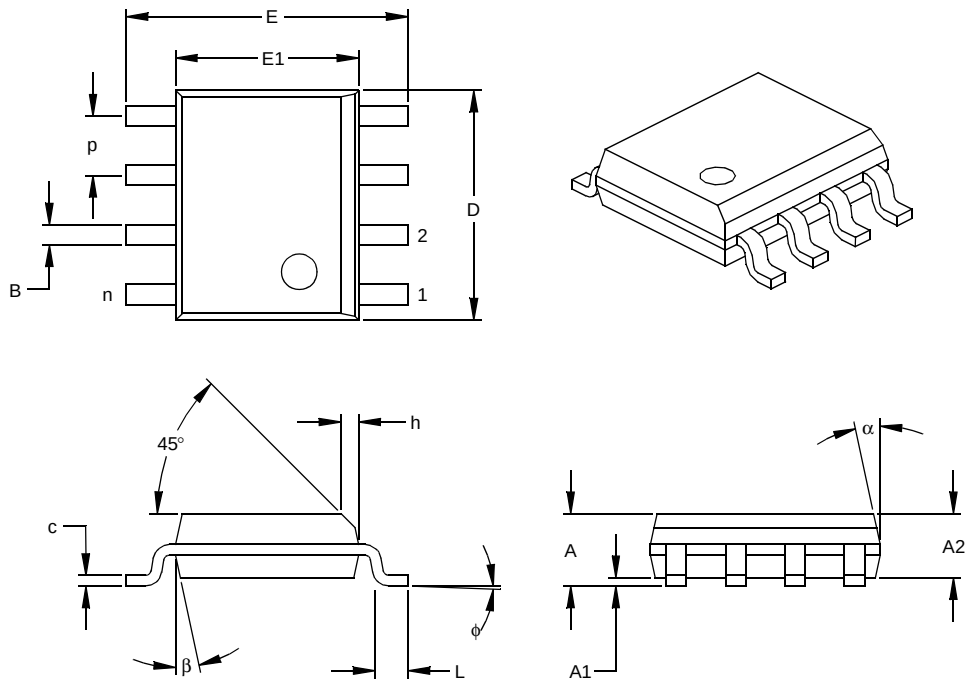
Notes:

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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Literature Number: **DS11184D**

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MCP120/130

NOTES:

NOTES:

MCP120/130

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.

<u>PART NO.</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>XX</u>
Device	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)			
RESET/RESET VTRIP Voltage	270 = $2.55 \leq V_{TRIP} \leq 2.70$ 300 = $2.85 \leq V_{TRIP} \leq 3.00$ 315 = $3.00 \leq V_{TRIP} \leq 3.15$ 450 = $4.25 \leq V_{TRIP} \leq 4.50$ 460 = $4.35 \leq V_{TRIP} \leq 4.60$ 475 = $4.50 \leq V_{TRIP} \leq 4.75$ 485 = $4.60 \leq V_{TRIP} \leq 4.85$			
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 = VTRIP range of 2.55V - 2.70V, Industrial Temp., SOIC package

b) MCP120-300DI/TO = VTRIP range of 2.85V - 3.00V, Bonding Option D, Industrial Temp., TO-92 package

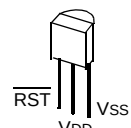
c) MCP120T-315I/TT = VTRIP range of 3.00V - 3.15V, Industrial Temp., SOT-23 package

d) MCP130-450I/SN = VTRIP range of 4.25V - 4.50V, Industrial Temp., SOIC package

e) MCP130-460FI/TO = VTRIP range of 4.35V - 4.60V, Bonding Option F, Industrial Temp., TO-92 package

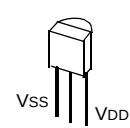
f) MCP130T-475I/TT = Tape & Reel, VTRIP range of 4.50V - 4.75V, Industrial Temp., SOT-23 package

TO-92 with 'D' Bondout



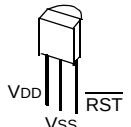
MCP120
MCP130

TO-92 with 'F' Bondout



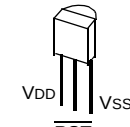
MCP130

TO-92 with 'G' Bondout



MCP120

TO-92 with 'H' Bondout



MCP120
MCP130

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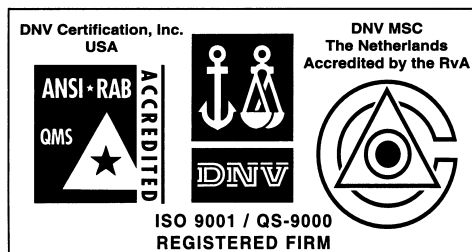
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Tel: 248-538-2250 Fax: 248-538-2260

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18201 Von Karman, Suite 1090
Irvine, CA 92612
Tel: 949-263-1888 Fax: 949-263-1338

Mountain View

Analog Product Sales
1300 Terra Bella Avenue
Mountain View, CA 94043-1836
Tel: 650-968-9241 Fax: 650-967-1590

New York

150 Motor Parkway, Suite 202
Hauppauge, NY 11788
Tel: 631-273-5305 Fax: 631-273-5335

San Jose

Microchip Technology Inc.
2107 North First Street, Suite 590
San Jose, CA 95131
Tel: 408-436-7950 Fax: 408-436-7955

Toronto

6285 Northam Drive, Suite 108
Mississauga, Ontario L4V 1X5, Canada
Tel: 905-673-0699 Fax: 905-673-6509

ASIA/PACIFIC

Australia

Microchip Technology Australia Pty Ltd
Suite 22, 41 Rawson Street
Epping 2121, NSW
Australia
Tel: 61-2-9868-6733 Fax: 61-2-9868-6755

China - Beijing

Microchip Technology Beijing Office
Unit 915
New China Hong Kong Manhattant Bldg.
No. 6 Chaoyangmen Beidajie
Beijing, 100027, No. China
Tel: 86-10-85282100 Fax: 86-10-85282104

China - Shanghai

Microchip Technology Shanghai Office
Room 701, Bldg. B
Far East International Plaza
No. 317 Xian Xia Road
Shanghai, 200051
Tel: 86-21-6275-5700 Fax: 86-21-6275-5060

Hong Kong

Microchip Asia Pacific
RM 2101, Tower 2, Metroplaza
223 Hing Fong Road
Kwai Fong, N.T., Hong Kong
Tel: 852-2401-1200 Fax: 852-2401-3431

India

Microchip Technology Inc.
India Liaison Office
Divyasree Chambers
1 Floor, Wing A (A3/A4)
No. 11, O'Shaughnessey Road
Bangalore, 560 025, India
Tel: 91-80-2290061 Fax: 91-80-2290062

Japan

Microchip Technology Intl. Inc.
Benex S-1 6F
3-18-20, Shinyokohama
Kohoku-Ku, Yokohama-shi
Kanagawa, 222-0033, Japan
Tel: 81-45-471-6166 Fax: 81-45-471-6122

ASIA/PACIFIC (continued)

Korea

Microchip Technology Korea
168-1, Youngbo Bldg. 3 Floor
Samsung-Dong, Kangnam-Ku
Seoul, Korea
Tel: 82-2-554-7200 Fax: 82-2-558-5934

Singapore

Microchip Technology Singapore Pte Ltd.
200 Middle Road
#07-02 Prime Centre
Singapore, 188980
Tel: 65-334-8870 Fax: 65-334-8850

Taiwan

Microchip Technology Taiwan
11F-3, No. 207
Tung Hua North Road
Taipei, 105, Taiwan
Tel: 886-2-2717-7175 Fax: 886-2-2545-0139

EUROPE

Denmark

Microchip Technology Denmark ApS
Regus Business Centre
Lautrup hof 1-3
Ballerup DK-2750 Denmark
Tel: 45 4420 9895 Fax: 45 4420 9910

France

Arizona Microchip Technology SARL
Parc d'Activite du Moulin de Massy
43 Rue du Saule Trapu
Batiment A - 1er Etage
91300 Massy, France
Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79

Germany

Arizona Microchip Technology GmbH
Gustav-Heinemann Ring 125
D-81739 Munich, Germany
Tel: 49-89-627-144 0 Fax: 49-89-627-144-44

Germany

Analog Product Sales
Lochhamer Strasse 13
D-82152 Martinsried, Germany
Tel: 49-89-895650-0 Fax: 49-89-895650-22

Italy

Arizona Microchip Technology SRL
Centro Direzionale Colleoni
Palazzo Taurus 1 V. Le Colleoni 1
20041 Agrate Brianza
Milan, Italy
Tel: 39-039-65791-1 Fax: 39-039-6899883

United Kingdom

Arizona Microchip Technology Ltd.
505 Eskdale Road
Winnersh Triangle
Wokingham
Berkshire, England RG41 5TU
Tel: 44 118 921 5869 Fax: 44-118 921-5820

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Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9