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MCP100/101

Microcontroller Supervisory Circuit with Push-Pull Output

Features

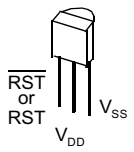
- Holds microcontroller in reset until supply voltage reaches stable operating level
- Resets microcontroller during power loss
- Precision monitoring of 3V, 3.3V and 5V systems
- 7 voltage trip points available
- Active low $\overline{\text{RESET}}$ pin (MCP100) or active high RESET (MCP101)
- Push-pull output
- Holds $\overline{\text{RESET}}$/RESET for 350 ms (typical)
- $\overline{\text{RESET}}$/RESET to V_{DD} = 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

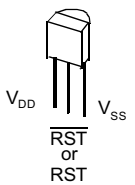
The Microchip Technology Inc. MCP100/101 is a voltage supervisory device designed to keep a microcontroller in reset until the system voltage has reached the proper level and stabilized. It also operates as protection from brown-out conditions when the supply voltage drops below a safe operating level. Both devices are available with a choice of seven different trip voltages and both have push-pull outputs. The MCP100 has a low active $\overline{\text{RESET}}$ pin and the MCP101 has a high active RESET pin. The MCP100/101 will assert the $\overline{\text{RESET}}$/RESET signal whenever the voltage on the V_{DD} pin is below the trip-point voltage.

Packages

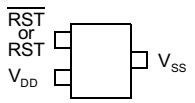
TO-92 with 'D' Bondout



TO-92 with 'H' Bondout

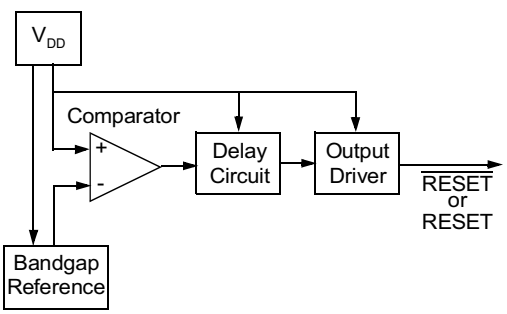


SOT-23-3



ILLUSTRATIONS NOT TO SCALE

Block Diagram



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1.0 ELECTRICAL CHARACTERISTICS

1.1 Maximum Ratings*

V_{DD}.....7.0V
All inputs and outputs w.r.t. VSS ..... -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 $\overline{\text{RESET}}$/RESET		V_{DDMIN}	1.0	—	—	V	
Operating Current		I_{DD}	—	45	60	µA	V_{DD} = 5.5V (no load)
V_{DD} Trip Point	MCP10X-270 MCP10X-300 MCP10X-315 MCP10X-450 MCP10X-460 MCP10X-475 MCP10X-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 (MCP100)	MCP100-270 MCP100-300 MCP100-315	V_{OL}	—	—	0.4	V	I_{OL} = 3.2 mA, V_{DD} = $V_{TRIPMIN}$
	MCP100-450 MCP100-460 MCP100-475 MCP100-485		—	—	0.6		I_{OL} = 8.5 mA, V_{DD} = $V_{TRIPMIN}$
$\overline{\text{RESET}}$ High Level Output Voltage (MCP100)	MCP100-XXX (All VTRIP Points)	V_{OH}	V_{DD}-0.7	—	—	V	I_{OH} = 3 mA, V_{DD} > $V_{TRIPMAX}$
RESET Low Level Output Voltage (MCP101)	MCP101-270 MCP101-300 MCP101-315	V_{OL}	—	—	0.4	V	I_{OL} = 3.2 mA, V_{DD} > $V_{TRIPMAX}$
	MCP101-450 MCP101-460 MCP101-475 MCP101-485		—	—	0.6		I_{OL} = 8.5 mA, V_{DD} > $V_{TRIPMAX}$
RESET High level Output Voltage (MCP101)	MCP101-XXX (All VTRIP Points)	V_{OH}	V_{DD}-0.7	—	—	V	I_{OH} = 3 mA, V_{DD} = $V_{TRIPMIN}$
Threshold Hysteresis		V_{HYS}	—	50	—	mV	
V_{DD} Detect to $\overline{\text{RESET}}$/RESET Inactive		t_{RPU}	150	350	700	ms	
V_{DD} Detect to $\overline{\text{RESET}}$/RESET		t_{RPD}	—	10	—	µs	V_{DD} ramped from $V_{TRIPMAX}$ + 250 mV down to $V_{TRIPMIN}$ - 250 mV

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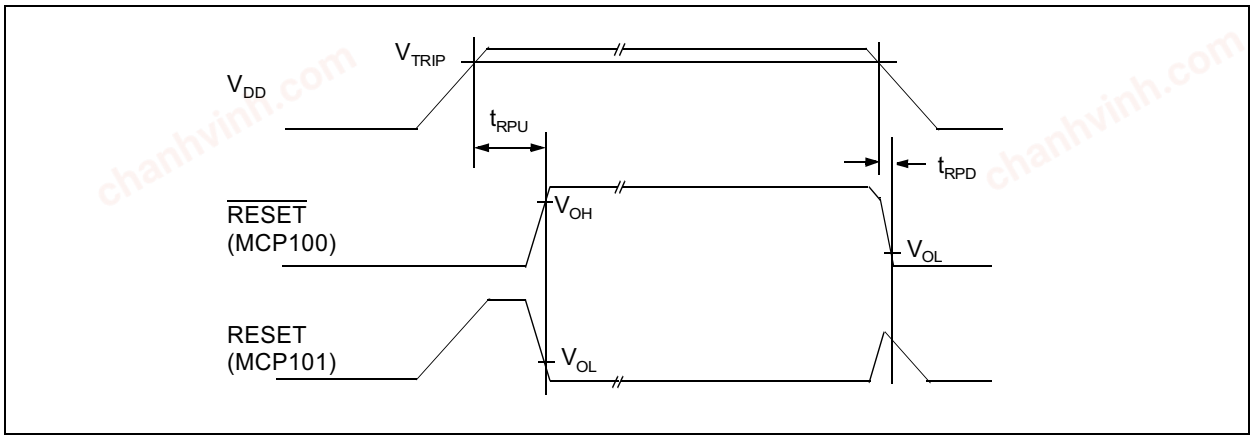


Figure 1-1: *MCP100/101 Timing Diagram*

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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.

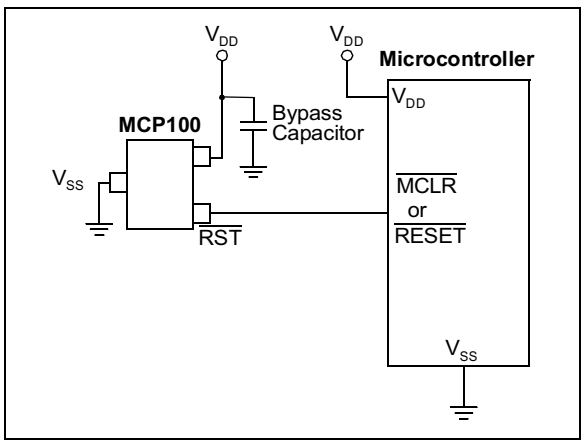


Figure 2-1: *Typical Application*

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.

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 duration vs. reset comparator overdrive for which the MCP100/101 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. A 0.1 µF bypass cap mounted as close as possible to the V_{DD} pin provides additional transient immunity.

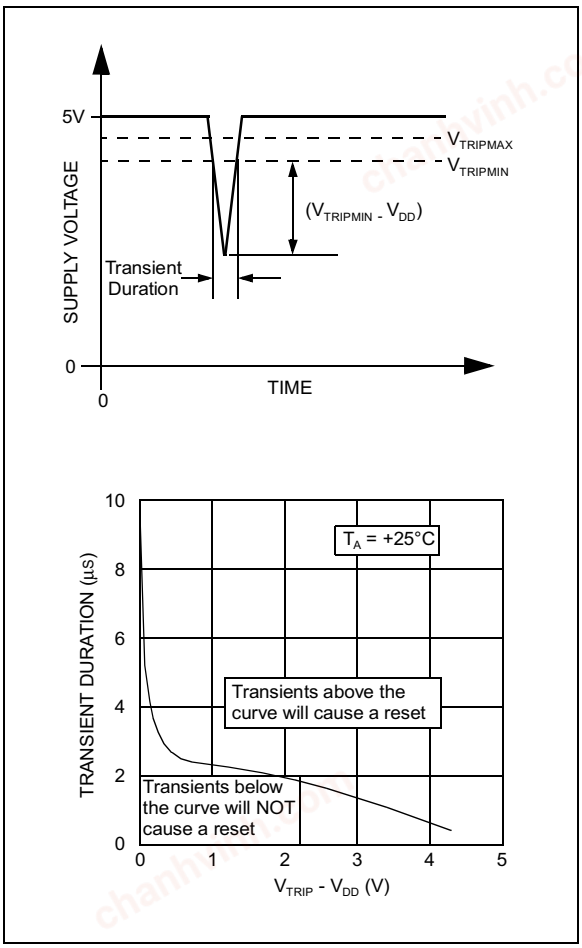


Figure 2-2: *Typical Transient Response*

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2.3 Effect of Temperature on Timeout Period (tRPU)

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

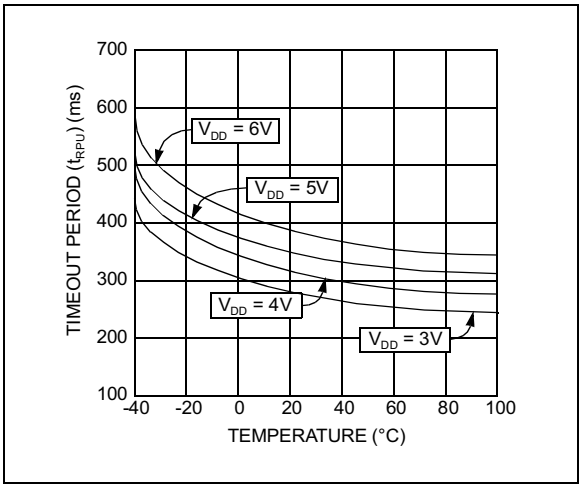


Figure 2-3: *Typical t_{RPU} vs. Temperature*

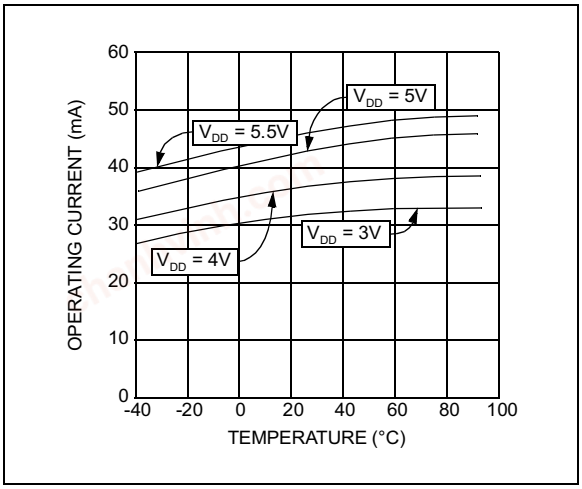


Figure 2-4: *I_{DD} vs. Temperature*

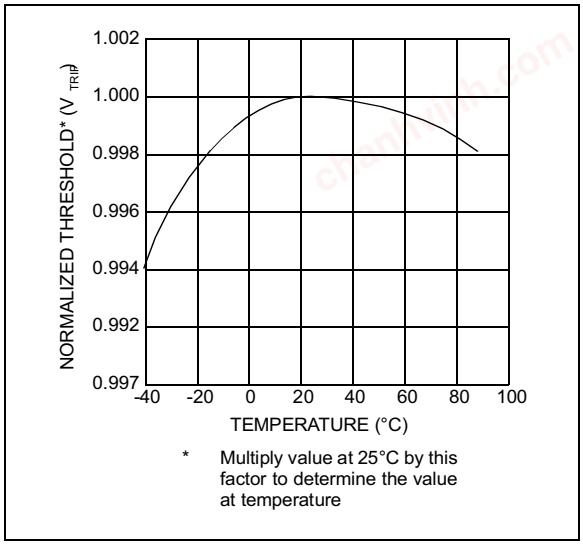


Figure 2-5: *Normalized VTRIP vs. Temperature*

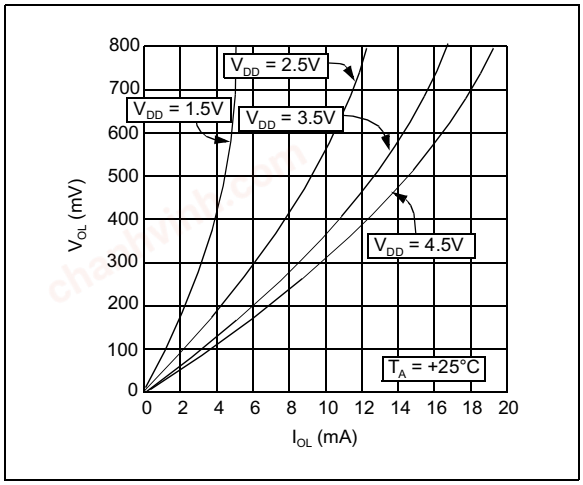
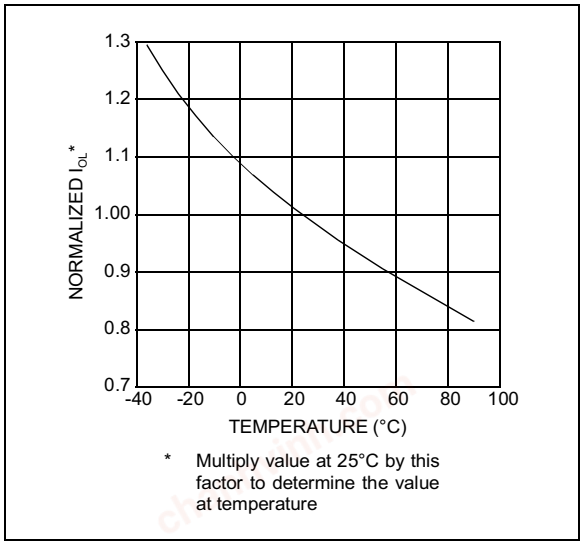


Figure 2-6: *V_{OL} vs. I_{OL}*



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Figure 2-7: *Normalized I_{OL} vs. Temperature*

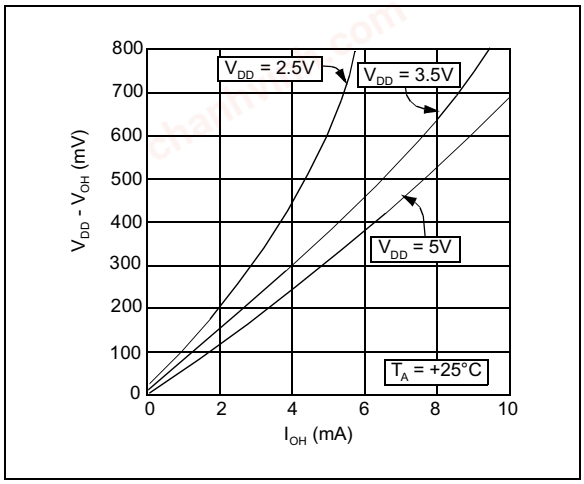


Figure 2-8: *V_{DD} - V_{OH} vs. I_{OH}*

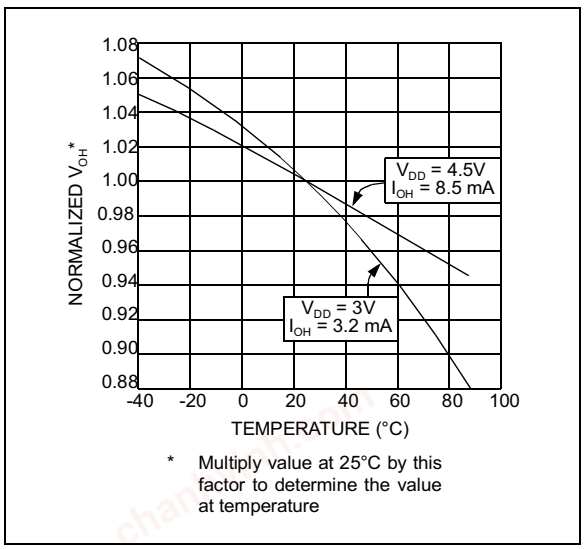


Figure 2-9: *Normalized V_{OH} vs. Temperature*

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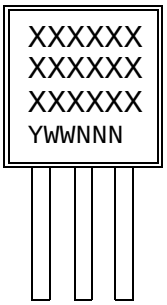
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3.0 PACKAGING INFORMATION

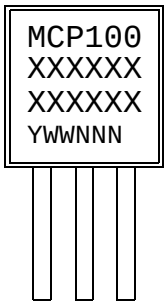
3.1 Package Marking Information

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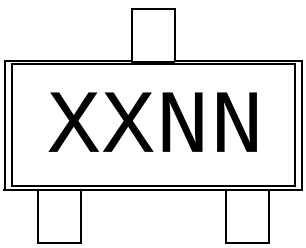
3-Lead Plastic Transistor Outline (TO-92)



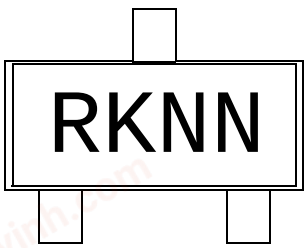
Example:



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
QJ	MCP100T-270I/TT	RJ	MCP101T-270I/TT
QK	MCP100T-300I/TT	RK	MCP101T-300I/TT
QL	MCP100T-315I/TT	RL	MCP101T-315I/TT
QM	MCP100T-450I/TT	RM	MCP101T-450I/TT
QN	MCP100T-460I/TT	RN	MCP101T-460I/TT
QO	MCP100T-475I/TT	RO	MCP101T-475I/TT
QP	MCP100T-485I/TT	RP	MCP101T-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

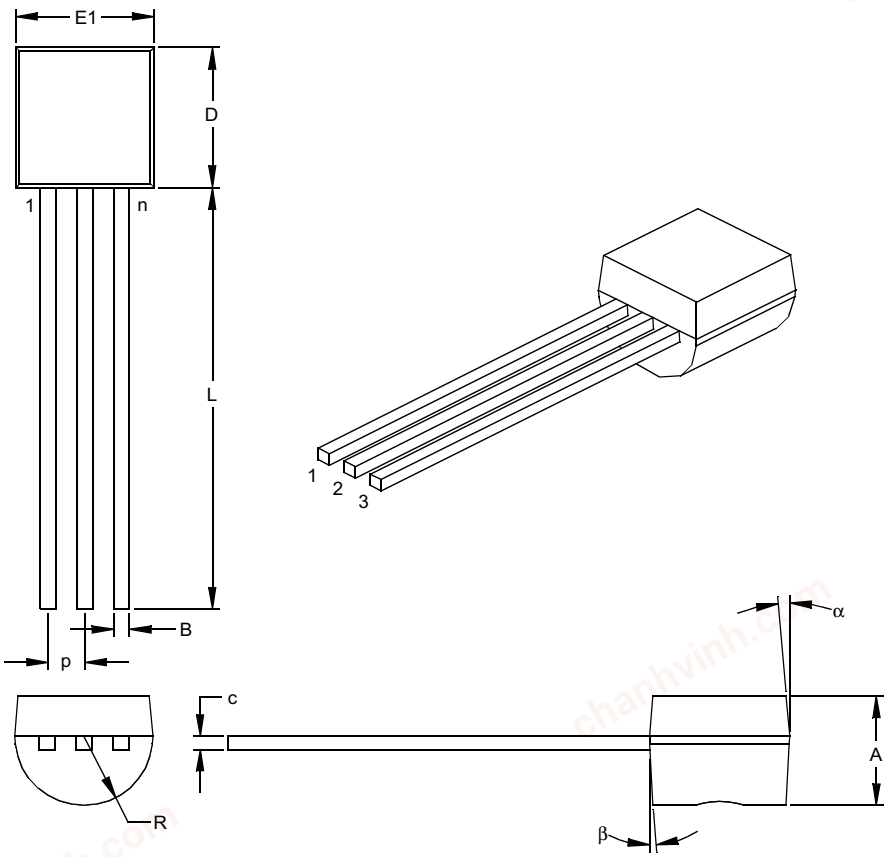
Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line thus limiting the number of available characters for customer specific information.

* Standard OTP marking consists of Microchip part number, year code, week code, and traceability code.

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3.2 Package Detail Information

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



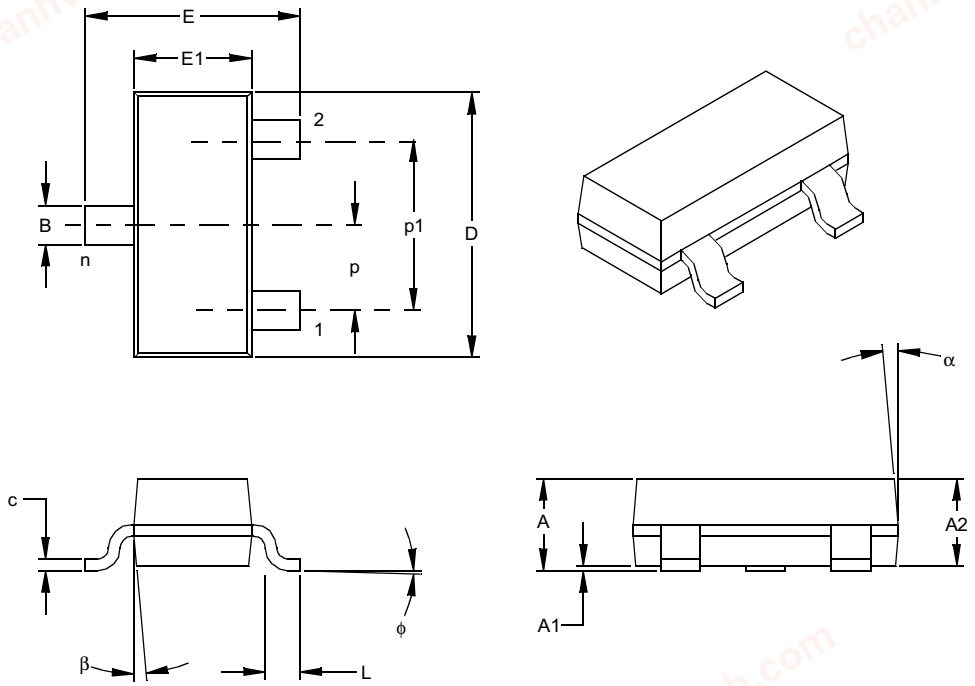
Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		3			3	
Pitch	p		.050			1.27	
Bottom to Package Flat	A	.130	.143	.155	3.30	3.62	3.94
Overall Width	E1	.175	.186	.195	4.45	4.71	4.95
Overall Length	D	.170	.183	.195	4.32	4.64	4.95
Molded Package Radius	R	.085	.090	.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

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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

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2. How does this document meet your hardware and software development needs?

3. Do you find the organization of this data sheet easy to follow? If not, why?

4. What additions to the data sheet do you think would enhance the structure and subject?

5. What deletions from the data sheet could be made without affecting the overall usefulness?

6. Is there any incorrect or misleading information (what and where)?

7. How would you improve this document?

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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	X	X	/XX
Device	$\overline{\text{RESET}}$/RESET V_{TRIP} Voltage	Bondout Option	Temperature Range	Package

Device:	MCP100:		Supervisor circuit with active low $\overline{\text{RESET}}$ output
	MCP100T:		Supervisor circuit with active low $\overline{\text{RESET}}$ output (tape & reel)
	MCP101:		Supervisor circuit with active high $\overline{\text{RESET}}$ output
	MCP101T:		Supervisor circuit with active high $\overline{\text{RESET}}$ output (tape & reel)
$\overline{\text{RESET}}$/RESET V_{TRIP} 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)
	H	=	H Bond Option
Temperature Range:	I	=	-40°C to +85°C (only offered in I)
Package:	TO	=	TO-92 (3-lead) [offered in bags only]
	TT	=	SOT-23 (3-lead) [offered in tape & reel only]

Examples:

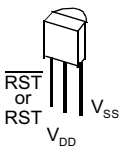
a) MCP100–270DI/TO = V_{TRIP} range of 2.55V - 2.70V, Bonding Option D, Industrial Temp., TO-92 package

b) MCP100T–450I/TT = V_{TRIP} range of 4.25V - 4.50V, Industrial Temp., SOT-23 package

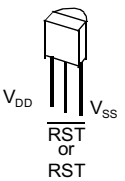
c) MCP101–270HI/TO = V_{TRIP} range of 2.55V - 2.70V, Bonding Option H, Industrial Temp., TO-92 package

d) MCP101T–315I/TT = V_{TRIP} range of 3.00V - 3.15V, Industrial Temp., SOT-23 package

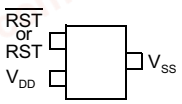
TO-92 with 'D' Bondout



TO-92 with 'H' Bondout



SOT-23-3



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:

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08/01/01

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