



**THE DATASHEET OF  
MCP809M3-2.93/NOPB**



## MCP809/MCP810 3-Pin Microprocessor Reset Circuits

 Check for Samples: [MCP809](#), [MCP810](#)

### FEATURES

- Precise Monitoring of 3V, 3.3V, and 5V Supply Voltages
- Fully specified over temperature
- 140ms min. Power-On Reset Pulse Width, 240ms Typical
  - Active-low  $\overline{\text{RESET}}$  Output (MCP809)
  - Active-high RESET Output (MCP810)
- Specified RESET Output Valid for  $V_{CC} \geq 1V$
- Low Supply Current, 15 $\mu\text{A}$  typical
- Power supply transient immunity

### APPLICATIONS

- Microprocessor Systems
- Computers
- Controllers
- Intelligent Instruments
- Portable/Battery-Powered Equipment
- Automotive

### Typical Application Circuit

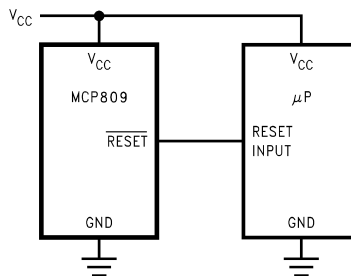


Figure 1. Typical Application Circuit

### Connection Diagram

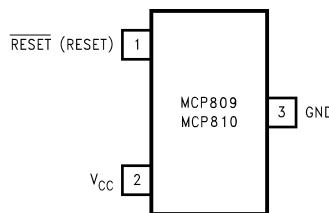


Figure 2. ( ) are for MCP810

### DESCRIPTION

The MCP809/810 microprocessor supervisory circuits can be used to monitor the power supplies in microprocessor and digital systems. They provide a reset to the microprocessor during power-up, power-down and brown-out conditions.

The function of the MCP809/810 is to monitor the  $V_{CC}$  supply voltage, and assert a reset signal whenever this voltage declines below the factory-programmed reset threshold. The reset signal remains asserted for 240ms after  $V_{CC}$  rises above the threshold. The MCP809 has an active-low  $\overline{\text{RESET}}$  output, while the MCP810 has an active-high RESET output.

Seven standard reset voltage options are available, suitable for monitoring 5V, 3.3V, and 3V supply voltages.

With a low supply current of only 15 $\mu\text{A}$ , the MCP809/810 are ideal for use in portable equipment. The MCP809/MCP810 are available in the 3-pin SOT23 package.



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## Pin Description

PIN	NAME	FUNCTION
3	GND	Ground reference
1	$\overline{\text{RESET}}$ (MCP809)	Active-low output. $\overline{\text{RESET}}$ remains low while $V_{CC}$ is below the reset threshold, and for 240ms after $V_{CC}$ rises above the reset threshold.
	RESET (MCP810)	Active-high output. RESET remains high while $V_{CC}$ is below the reset threshold, and for 240ms after $V_{CC}$ rises above the reset threshold.
2	$V_{CC}$	Supply Voltage (+5V, +3.3V, or +3.0V)



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

## Absolute Maximum Ratings <sup>(1)</sup>

$V_{CC}$	-0.3V to 6.0V
RESET, $\overline{\text{RESET}}$	-0.3V to ( $V_{CC} + 0.3V$ )
Input Current, $V_{CC}$ Pin	20mA
Output Current, RESET, $\overline{\text{RESET}}$ Pin	20mA
Rate of Rise, $V_{CC}$	100V/ $\mu$ s
ESD Rating <sup>(2)</sup>	2kV
Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ )	
SOT-23 <sup>(3)</sup>	320mW
Ambient Temperature Range	-40°C to +105°C
Maximum Junction Temperature	125°C
Storage Temperature Range	-65°C to +160°C
Lead Temperature (soldering, 10sec)	+300°C

(1) Absolute Maximum Ratings are limits beyond which damage to the device may occur. Operating Ratings are conditions under which the device operates correctly. Operating ratings do not imply specified performance limits. For specified performance limits and associated test conditions, see the Electrical Characteristics.

(2) The human body model is a 100pF capacitor discharged through a 1.5k $\Omega$  resistor into each pin.

(3) Production testing done at  $T_A = +25^\circ\text{C}$ , over temperature limits specified by design only.

## Electrical Characteristics

$V_{CC}$  = full range,  $T_A$  =  $-40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$ , unless otherwise noted. Typical values are at  $T_A$  =  $+25^{\circ}\text{C}$ ,  $V_{CC}$  = 5V for 4.63/4.38/4.00 versions,  $V_{CC}$  = 3.3V for 3.08/2.93 versions, and  $V_{CC}$  = 3V for 2.63 version. <sup>(1)</sup>

Symbol	Parameter	Conditions	Min	Typ	Max	Units			
	$V_{CC}$ Range	$T_A$ = $0^{\circ}\text{C}$ to $+70^{\circ}\text{C}$	1.0		5.5	V			
		$T_A$ = $-40^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	1.2		5.5				
$I_{CC}$	Supply Current	$T_A$ = $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	$V_{CC}$ < 5.5V, MCP8__ - 4.63/4.38/4.00	18	60	$\mu\text{A}$			
			$V_{CC}$ < 3.6V, MCP8__ - 3.08/2.93/2.63	15	50				
		$T_A$ = $+85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	$V_{CC}$ < 5.5V, MCP8__ - 4.63/4.38/4.00		100				
			$V_{CC}$ < 3.6V, MCP8__ - 3.08/2.93/2.63		100				
$V_{TH}$	Reset Threshold <sup>(2)</sup>	MCP8__ -4.63	$T_A$ = $+25^{\circ}\text{C}$	4.56	4.63	4.70	V		
			$T_A$ = $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	4.50		4.75			
			$T_A$ = $+85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	4.40		4.86			
		MCP8__ -4.38	$T_A$ = $+25^{\circ}\text{C}$	4.31	4.38	4.45			
			$T_A$ = $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	4.25		4.50			
			$T_A$ = $+85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	4.16		4.56			
		MCP8__ -4.00	$T_A$ = $+25^{\circ}\text{C}$	3.93	4.00	4.06			
			$T_A$ = $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	3.89		4.10			
			$T_A$ = $+85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	3.80		4.20			
		MCP8__ -3.08	$T_A$ = $+25^{\circ}\text{C}$	3.04	3.08	3.11			
			$T_A$ = $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	3.00		3.15			
			$T_A$ = $+85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	2.92		3.23			
		MCP8__ -2.93	$T_A$ = $+25^{\circ}\text{C}$	2.89	2.93	2.96			
			$T_A$ = $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	2.85		3.00			
			$T_A$ = $+85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	2.78		3.08			
		MCP8__ -2.63	$T_A$ = $+25^{\circ}\text{C}$	2.59	2.63	2.66			
			$T_A$ = $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	2.55		2.70			
			$T_A$ = $+85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	2.50		2.76			
			Reset Threshold Temperature Coefficient			30			ppm/ $^{\circ}\text{C}$
			$V_{CC}$ to Reset Delay <sup>(2)</sup>	$V_{CC} = V_{TH}$ to $(V_{TH} - 100\text{mV})$		20			$\mu\text{s}$
			Reset Active Timeout Period	$T_A$ = $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	140	240		560	ms
				$T_A$ = $+85^{\circ}\text{C}$ to $+105^{\circ}\text{C}$	100			840	

(1) At elevated temperatures, devices must be derated based on package thermal resistance. The device in the SOT23-3 package must be derated at 4mW/ $^{\circ}\text{C}$  at ambient temperatures above  $70^{\circ}\text{C}$ . The device has internal thermal protection.

(2) RESET Output for MCP809, RESET output for MCP810.

**Electrical Characteristics (continued)**

$V_{CC}$  = full range,  $T_A$  =  $-40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$ , unless otherwise noted. Typical values are at  $T_A$  =  $+25^{\circ}\text{C}$ ,  $V_{CC}$  = 5V for 4.63/4.38/4.00 versions,  $V_{CC}$  = 3.3V for 3.08/2.93 versions, and  $V_{CC}$  = 3V for 2.63 version. <sup>(1)</sup>

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$V_{OL}$	$\overline{\text{RESET}}$ Output Voltage Low (MCP809)	$V_{CC} = V_{TH \text{ min}}$ , $I_{SINK} = 1.2\text{mA}$ , MCP809-2.63/2.93/3.08			0.3	V
		$V_{CC} = V_{TH \text{ min}}$ , $I_{SINK} = 3.2\text{mA}$ , MCP809-4.63/4.38/4.00			0.4	
		$V_{CC} > 1.0\text{V}$ , $I_{SINK} = 50\mu\text{A}$			0.3	
$V_{OH}$	$\overline{\text{RESET}}$ Output Voltage High (MCP809)	$V_{CC} > V_{TH \text{ max}}$ , $I_{SOURCE} = 500\mu\text{A}$ , MCP809-2.63/2.93/3.08	$0.8V_{CC}$			V
		$V_{CC} > V_{TH \text{ max}}$ , $I_{SOURCE} = 800\mu\text{A}$ , MCP809-4.63/4.38/4.00	$V_{CC}-1.5$			
$V_{OL}$	RESET Output Voltage Low (MCP810)	$V_{CC} = V_{TH \text{ max}}$ , $I_{SINK} = 1.2\text{mA}$ , MCP810-2.63/2.93/3.08			0.3	V
		$V_{CC} = V_{TH \text{ max}}$ , $I_{SINK} = 3.2\text{mA}$ , MCP810-4.63/4.38/4.00			0.4	
$V_{OH}$	RESET Output Voltage High (MCP810)	$1.8\text{V} < V_{CC} < V_{TH \text{ min}}$ , $I_{SOURCE} = 150\mu\text{A}$	$0.8V_{CC}$			V

TYPICAL PERFORMANCE CHARACTERISTICS

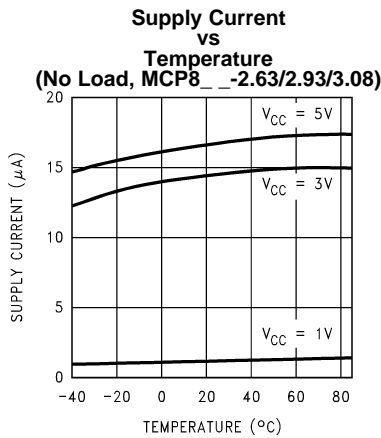


Figure 3.

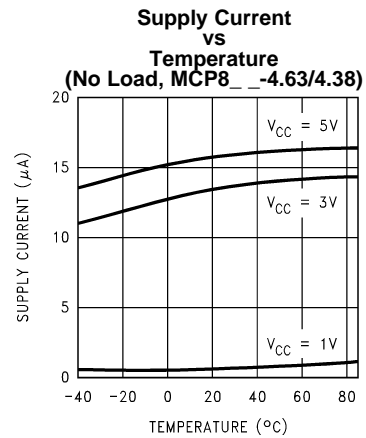


Figure 4.

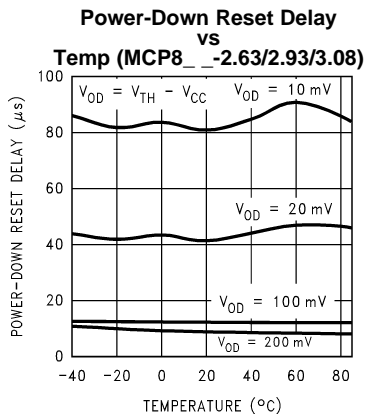


Figure 5.

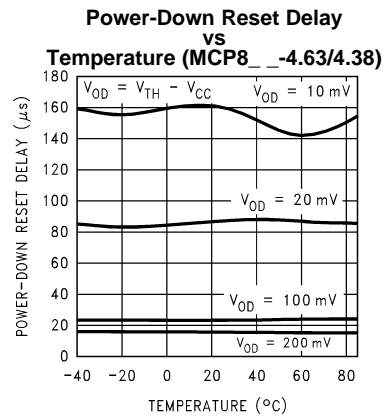


Figure 6.

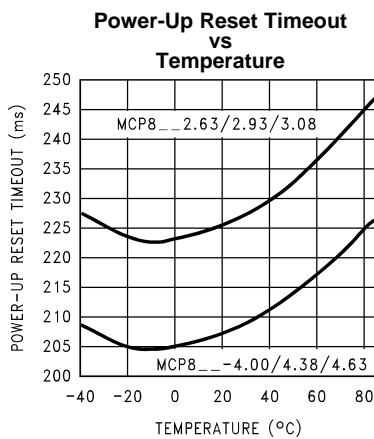


Figure 7.

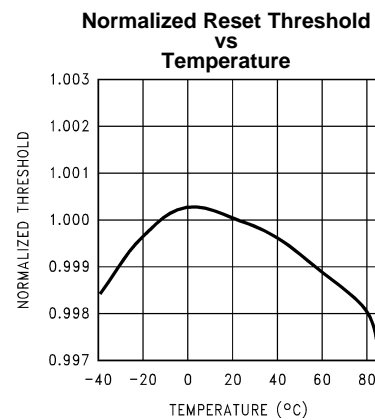


Figure 8.

## APPLICATION INFORMATION

### Benefits of Precision Reset Thresholds

A microprocessor supply supervisor must provide a reset output within a predictable range of the supply voltage. A common threshold range is between 5% and 10% below the nominal supply voltage. The 4.63V and 3.08V options of the MCP809/810 use highly accurate circuitry to ensure that the reset threshold occurs only within this range (for 5V and 3.3V supplies). The other voltage options have the same tight tolerance to ensure a reset signal for other narrow monitor ranges. See [Table 1](#) for examples of how the standard reset thresholds apply to 3V, 3.3V, and 5V nominal supply voltages.

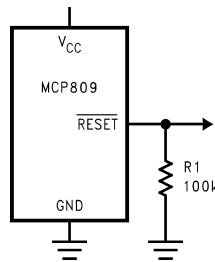
**Table 1. Reset Thresholds Related to Common Supply Voltages**

Reset Threshold	3.0V	3.3V	5.0V
4.63 ± 3%			90 - 95%
4.38 ± 3%			85 - 90%
4.00 ± 3%			78 - 82%
3.08 ± 3%		90 - 95%	
2.93 ± 3%		86 - 90%	
2.63 ± 3%	85 - 90%	77 - 81%	

### Ensuring a Valid Reset Output Down to $V_{CC} = 0V$

When  $V_{CC}$  falls below 1V, the MCP809  $\overline{\text{RESET}}$  output no longer sinks current. A high-impedance CMOS logic input connected to  $\overline{\text{RESET}}$  can therefore drift to undetermined voltages. To prevent this situation, a 100k $\Omega$  resistor should be connected from the  $\overline{\text{RESET}}$  output to ground, as shown in [Figure 9](#).

A 100k $\Omega$  pull-up resistor to  $V_{CC}$  is also recommended for the MCP810, if  $\overline{\text{RESET}}$  is required to remain valid for  $V_{CC} < 1V$ .



**Figure 9.  $\overline{\text{RESET}}$  Valid to  $V_{CC} = \text{Ground}$  Circuit**

### Negative-Going $V_{CC}$ Transients

The MCP809/810 are relatively immune to short negative-going transients or glitches on  $V_{CC}$ . [Figure 10](#) shows the maximum pulse width a negative-going  $V_{CC}$  transient can have without causing a reset pulse. In general, as the magnitude of the transient increases, going further below the threshold, the maximum allowable pulse width decreases. Typically, for the 4.63V and 4.38V version of the MCP809/810, a  $V_{CC}$  transient that goes 100mV below the reset threshold and lasts 20 $\mu\text{s}$  or less will not cause a reset pulse. A 0.1  $\mu\text{F}$  bypass capacitor mounted as close as possible to the  $V_{CC}$  pin will provide additional transient rejection.

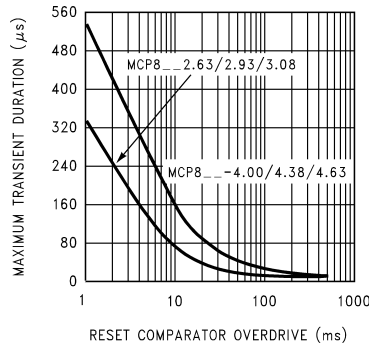


Figure 10. Maximum Transient Duration without Causing a Reset Pulse vs. Reset Comparator Overdrive

### Interfacing to $\mu$ Ps with Bidirectional Reset Pins

Microprocessors with bidirectional reset pins, such as the Motorola 68HC11 series, can be connected to the MCP809  $\overline{\text{RESET}}$  output. To ensure a correct output on the MCP809 even when the microprocessor reset pin is in the opposite state, connect a 4.7k $\Omega$  resistor between the MCP809  $\overline{\text{RESET}}$  output and the  $\mu$ P reset pin, as shown in Figure 11. Buffer the MCP809  $\overline{\text{RESET}}$  output to other system components.

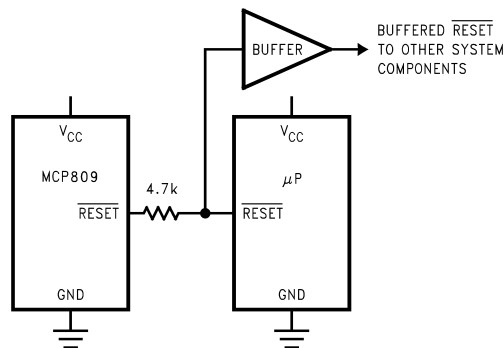


Figure 11. Interfacing to Microprocessors with Bidirectional Reset I/O

## REVISION HISTORY

Changes from Original (May 2013) to Revision A	Page
• Changed layout of National Data Sheet to TI format .....	<a href="#">7</a>

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
MCP809M3-2.93/NOPB	ACTIVE	SOT-23	DBZ	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 105	SRB	Samples

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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## TAPE AND REEL INFORMATION



### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
MCP809M3-2.93/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

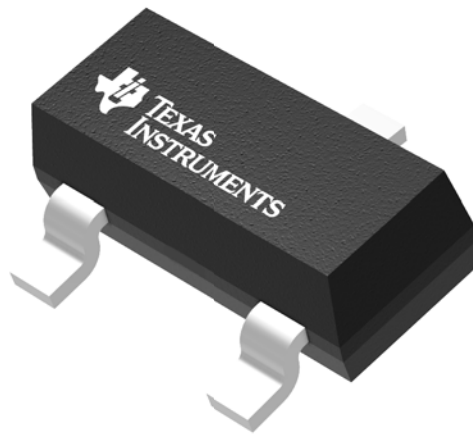
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
MCP809M3-2.93/NOPB	SOT-23	DBZ	3	1000	210.0	185.0	35.0

## GENERIC PACKAGE VIEW

**DBZ 3**

**SOT-23 - 1.12 mm max height**

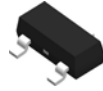
SMALL OUTLINE TRANSISTOR



Images above are just a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.

4203227/C

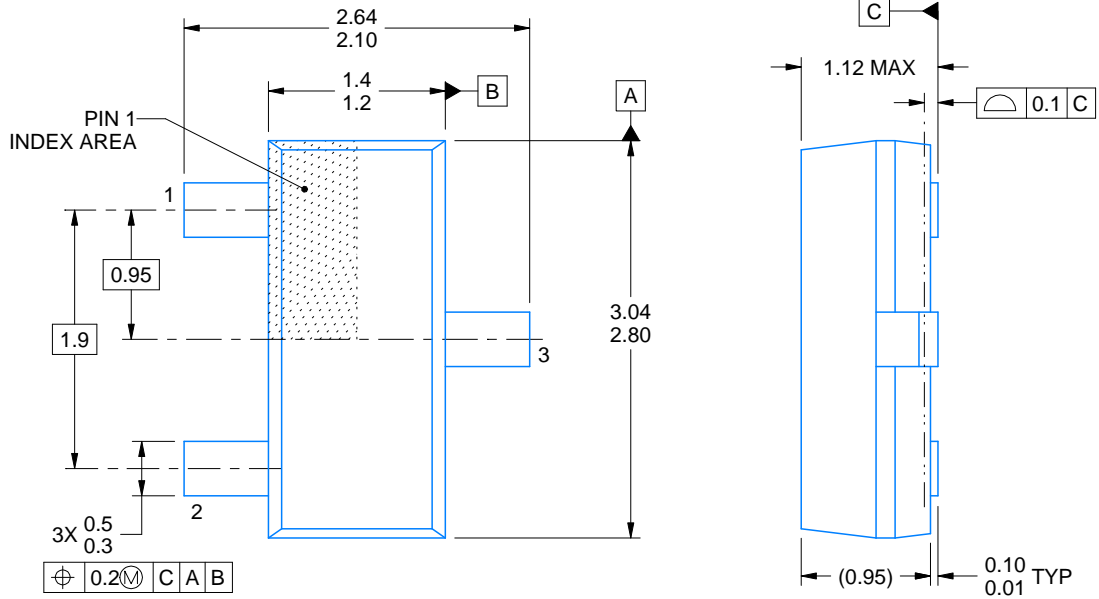
DBZ0003A



# PACKAGE OUTLINE

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



4214838/C 04/2017

NOTES:

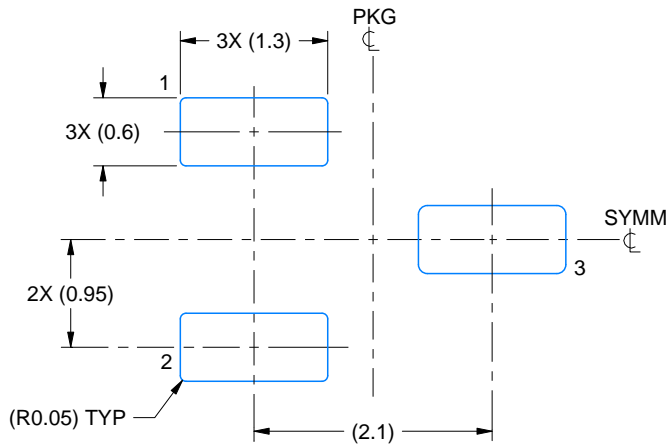
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration TO-236, except minimum foot length.

# EXAMPLE BOARD LAYOUT

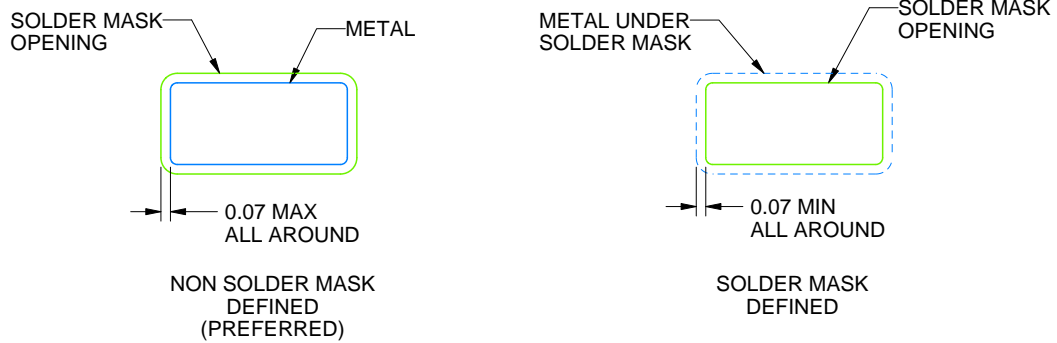
DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
SCALE:15X



SOLDER MASK DETAILS

4214838/C 04/2017

NOTES: (continued)

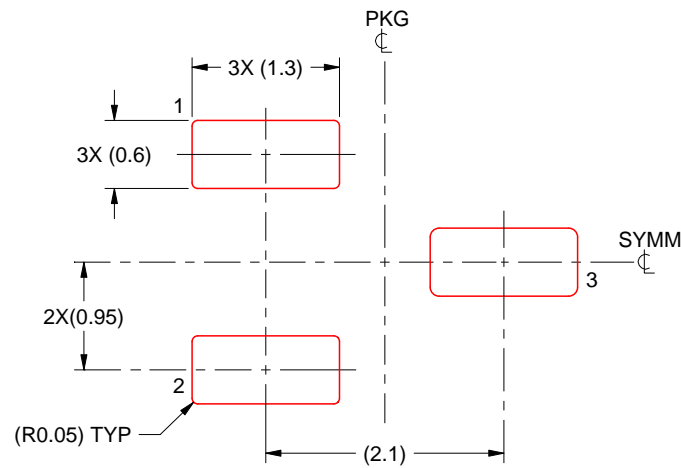
4. Publication IPC-7351 may have alternate designs.
5. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE  
BASED ON 0.125 THICK STENCIL  
SCALE:15X

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NOTES: (continued)

6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
7. Board assembly site may have different recommendations for stencil design.

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