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}≥1V**
- **Low Supply Current, 15µA typical**
- **Power supply transient immunity**

APPLICATIONS

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

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 15µA, the MCP809/810 are ideal for use in portable equipment. The MCP809/MCP810 are available in the 3-pin SOT23 package.

Typical Application Circuit

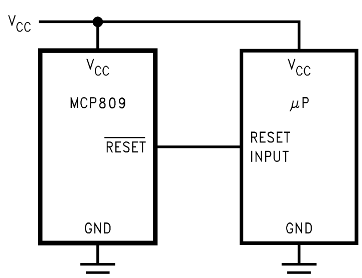

Figure 1. Typical Application Circuit

Connection Diagram

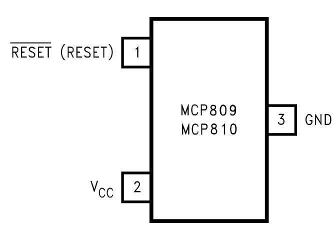

Figure 2. ( ) are for MCP810

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 (1)

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/µs
ESD Rating (2)	2kV
Continuous Power Dissipation (T_A = +70°C)	
SOT-23 (3)	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 1.5kΩ resistor into each pin.
(3) Production testing done at T_A = +25°C, over temperature limits specified by design only.

Electrical Characteristics

V_{CC} = full range, T_A = −40°C to +105°C, unless otherwise noted. Typical values are at T_A = +25°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. (1)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
	V_{CC} Range	T_A = 0°C to +70°C		1.0		5.5	V
		T_A = −40°C to +105°C		1.2		5.5	
I_{CC}	Supply Current	T_A = −40°C to +85°C	V_{CC}<5.5V, MCP8_ _ -4.63/4.38/4.00		18	60	µA
			V_{CC}<3.6V, MCP8_ _ -3.08/2.93/2.63		15	50	
		T_A = +85°C to +105°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 (2)	MCP8_ _ -4.63	T_A = +25°C	4.56	4.63	4.70	V
			T_A = −40°C to +85°C	4.50		4.75	
			T_A = +85°C to +105°C	4.40		4.86	
		MCP8_ _ -4.38	T_A = +25°C	4.31	4.38	4.45	
			T_A = −40°C to +85°C	4.25		4.50	
			T_A = +85°C to +105°C	4.16		4.56	
		MCP8_ _ -4.00	T_A = +25°C	3.93	4.00	4.06	
			T_A = −40°C to +85°C	3.89		4.10	
			T_A = +85°C to +105°C	3.80		4.20	
		MCP8_ _ -3.08	T_A = +25°C	3.04	3.08	3.11	
			T_A = −40°C to +85°C	3.00		3.15	
			T_A = +85°C to +105°C	2.92		3.23	
		MCP8_ _ -2.93	T_A = +25°C	2.89	2.93	2.96	
			T_A = −40°C to +85°C	2.85		3.00	
			T_A = +85°C to +105°C	2.78		3.08	
		MCP8_ _ -2.63	T_A = +25°C	2.59	2.63	2.66	
			T_A = −40°C to +85°C	2.55		2.70	
			T_A = +85°C to +105°C	2.50		2.76	
	Reset Threshold Temperature Coefficient				30		ppm/°C
	V_{CC} to Reset Delay (2)	V_{CC} = V_{TH} to (V_{TH} − 100mV)			20		µs
	Reset Active Timeout Period	T_A = −40°C to +85°C		140	240	560	ms
		T_A = +85°C to +105°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/°C at ambient temperatures above 70°C. The device has internal thermal protection.
(2) $\overline{RESET}$ Output for MCP809, RESET output for MCP810.

Electrical Characteristics (continued)

V_{CC} = full range, T_A = −40°C to +105°C, unless otherwise noted. Typical values are at T_A = +25°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. (1)

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

TYPICAL PERFORMANCE CHARACTERISTICS

Supply Current vs Temperature (No Load, MCP8_ _-2.63/2.93/3.08)

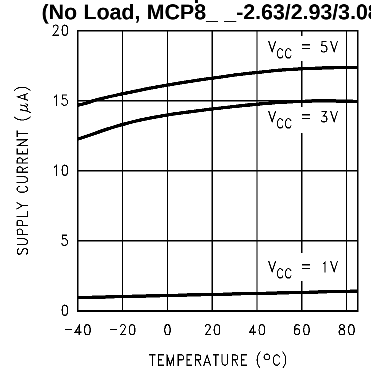

Figure 3.

Supply Current vs Temperature (No Load, MCP8_ _-4.63/4.38)

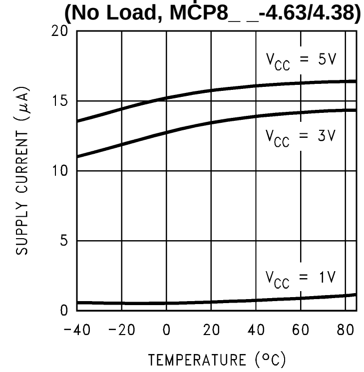

Figure 4.

Power-Down Reset Delay vs Temp (MCP8_ _-2.63/2.93/3.08)

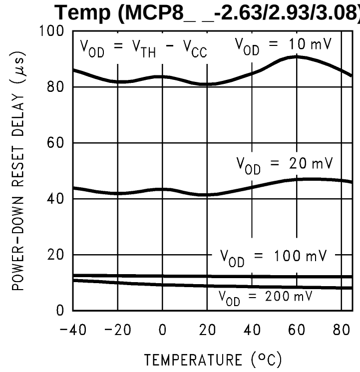

Figure 5.

Power-Down Reset Delay vs Temperature (MCP8_ _-4.63/4.38)

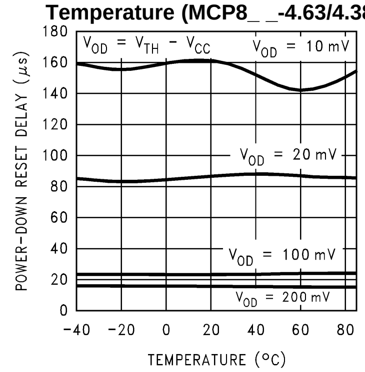

Figure 6.

Power-Up Reset Timeout vs Temperature

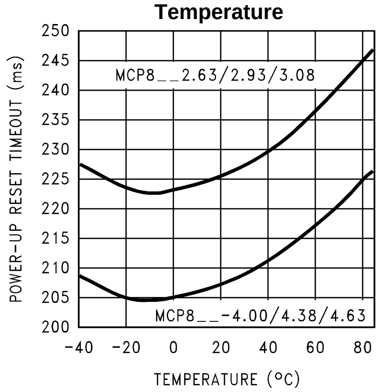

Figure 7.

Normalized Reset Threshold vs Temperature

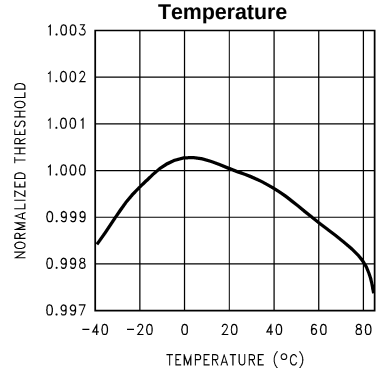

Figure 8.

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 $\overline{RESET}$ output no longer sinks current. A high-impedance CMOS logic input connected to $\overline{RESET}$ can therefore drift to undetermined voltages. To prevent this situation, a 100kΩ resistor should be connected from the $\overline{RESET}$ output to ground, as shown in Figure 9.

A 100kΩ pull-up resistor to V_{CC} is also recommended for the MCP810, if RESET is required to remain valid for V_{CC} < 1V.

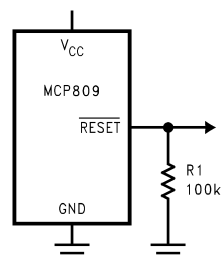

Figure 9. $\overline{RESET}$ Valid to V_{CC} = Ground Circuit

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 20µs or less will not cause a reset pulse. A 0.1 µF bypass capacitor mounted as close as possible to the V_{CC} pin will provide additional transient rejection.

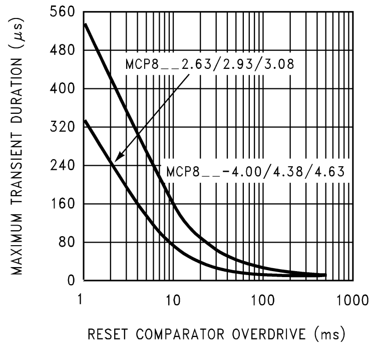

Figure 10. Maximum Transient Duration without Causing a Reset Pulse vs. Reset Comparator Overdrive

Interfacing to µPs 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 4.7kΩ resistor between the MCP809 $\overline{\text{RESET}}$ output and the µP reset pin, as shown in Figure 11. Buffer the MCP809 $\overline{\text{RESET}}$ output to other system components.

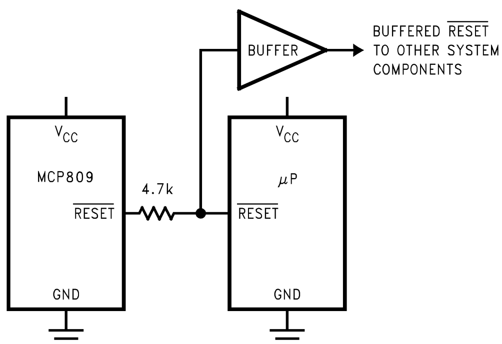

Figure 11. Interfacing to Microprocessors with Bidirectional Reset I/O

REVISION HISTORY

Changes from Original (May 2013) to Revision A	Page
• Changed layout of National Data Sheet to TI format	7

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
MCP809M3-2.93/NOPB	Active	Production	SOT-23 (DBZ) | 3	1000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 105	SRB
MCP809M3-2.93/NOPB.A	Active	Production	SOT-23 (DBZ) | 3	1000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 105	SRB
MCP809M3-2.93/NOPB.B	Active	Production	SOT-23 (DBZ) | 3	1000 | LARGE T&R	-	Call TI	Call TI	-40 to 105	

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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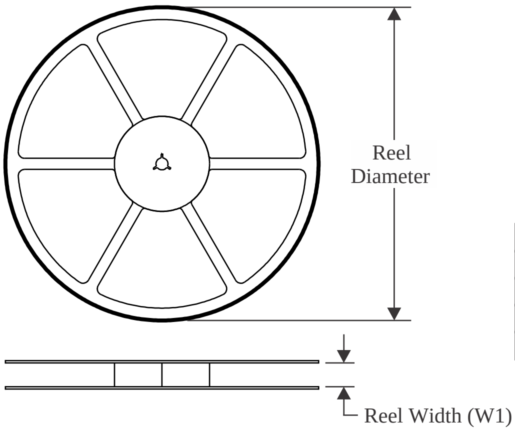
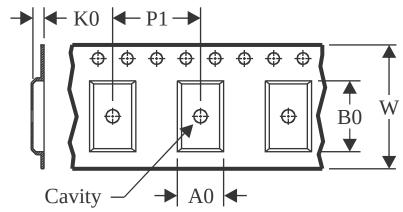
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

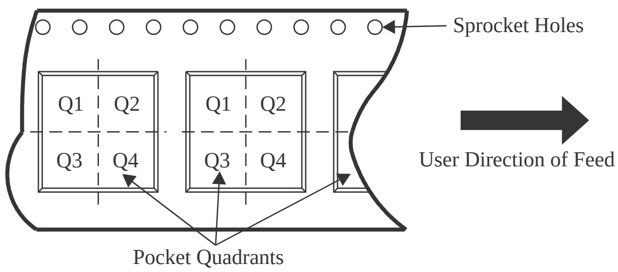


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

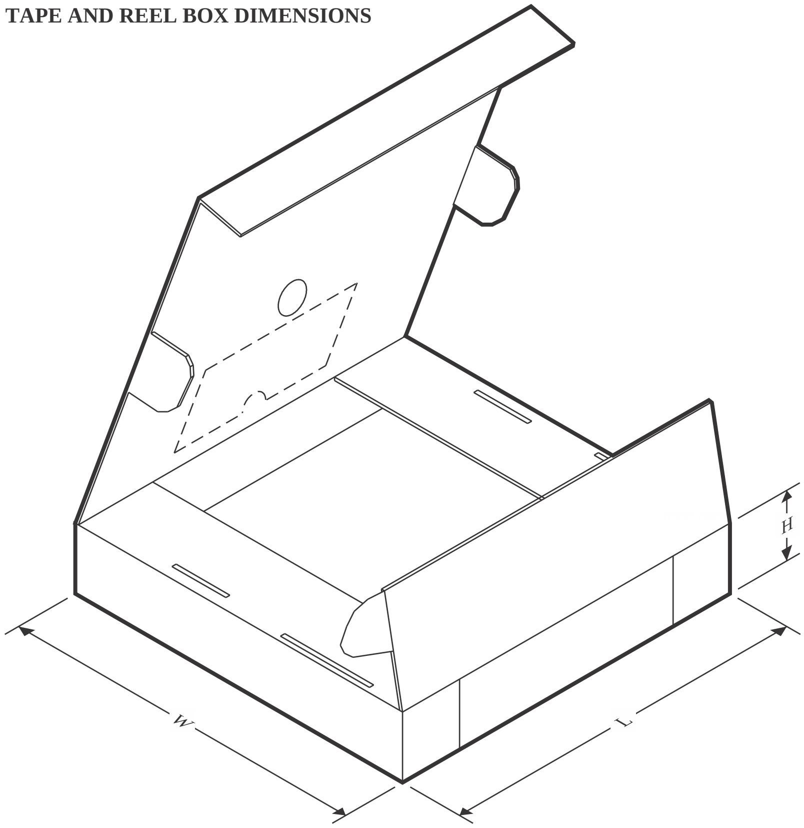
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

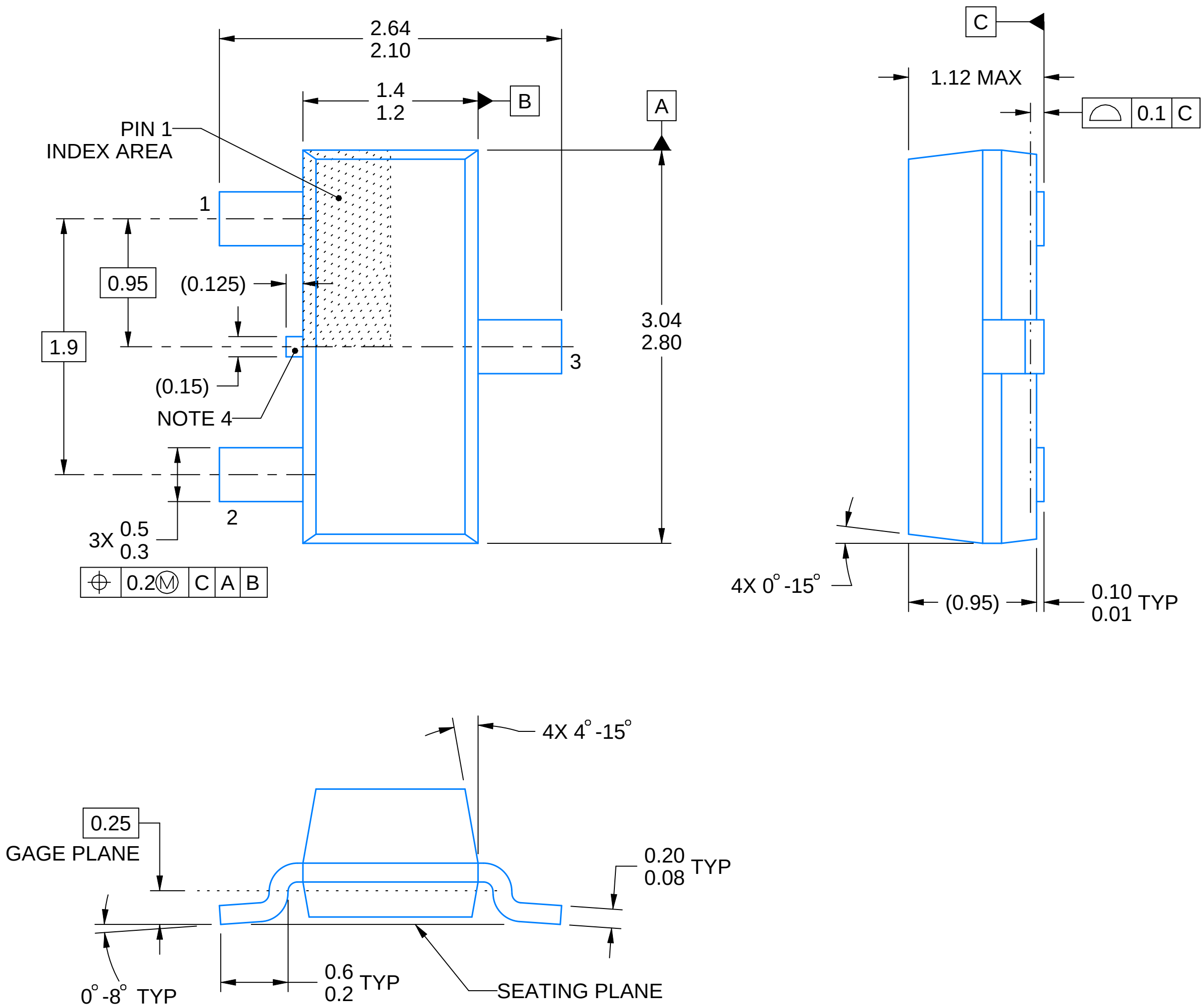
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
MCP809M3-2.93/NOPB	SOT-23	DBZ	3	1000	178.0	8.4	3.3	2.9	1.22	4.0	8.0	Q3

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	208.0	191.0	35.0



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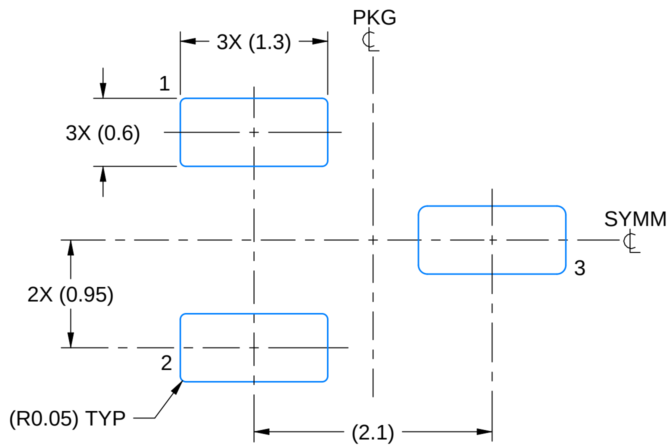
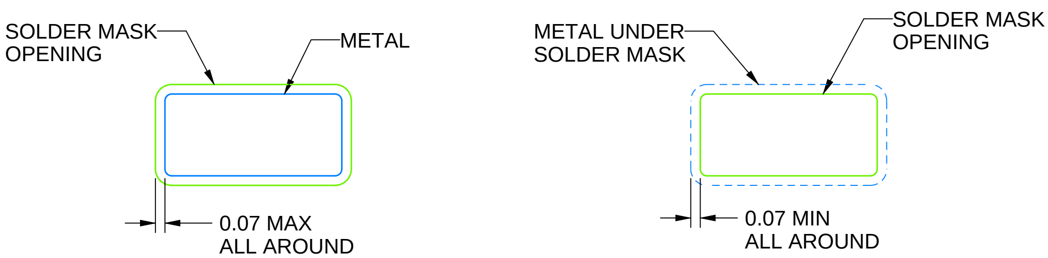
NOTES:

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.
4. Support pin may differ or may not be present.
5. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25mm per side



LAND PATTERN EXAMPLE
SCALE:15X



NON SOLDER MASK DEFINED (PREFERRED)

SOLDER MASK DEFINED

SOLDER MASK DETAILS

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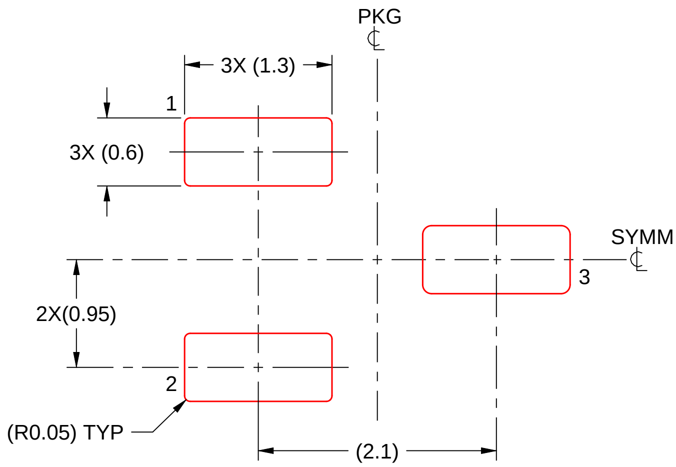
NOTES: (continued)

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



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

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NOTES: (continued)

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