



**THE DATASHEET OF  
LM3704XCMMX-263**



# LM3704,LM3705

*LM3704/LM3705 Microprocessor Supervisory Circuits with Power Fail Input,  
Low Line Output and Manual Reset*



Literature Number: SNVS088D

# LM3704/LM3705 Microprocessor Supervisory Circuits with Power Fail Input, Low Line Output and Manual Reset

## General Description

The LM3704/LM3705 series of microprocessor supervisory circuits provide the maximum flexibility for monitoring power supplies and battery controlled functions in systems without backup batteries. The LM3704/LM3705 series are available in MSOP-10 and 9-bump micro SMD packages.

Built-in features include the following:

**Reset:** Reset is asserted during power-up, power-down, and brownout conditions.  $\overline{\text{RESET}}$  is guaranteed down to  $V_{CC}$  of 1.0V.

**Manual Reset Input:** An input that asserts reset when pulled low.

**Power-Fail Input:** A 1.225V threshold detector for power fail warning, or to monitor a power supply other than  $V_{CC}$ .

**Low Line Output:** This early power failure warning indicator goes low when the supply voltage drops to a value which is 2% higher than the reset threshold voltage.

## Features

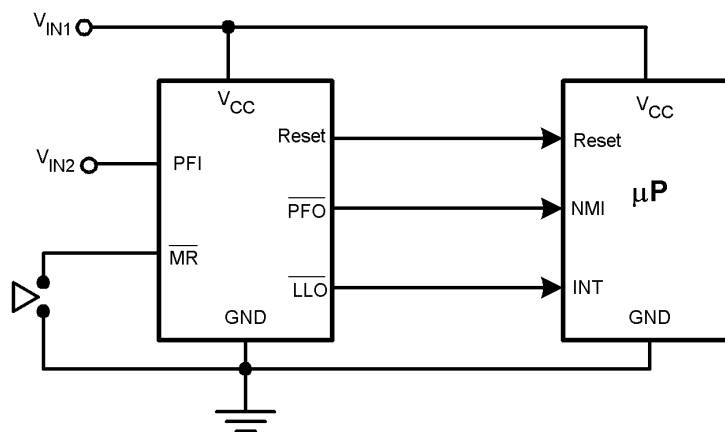
- Standard Reset Threshold voltage: 3.08V
- Custom Reset Threshold voltages: For other voltages between 2.2V and 5.0V in 10mV increments, contact National Semiconductor Corp.

- No external components required
- Manual-Reset input
- $\overline{\text{RESET}}$  (LM3704) or RESET (LM3705) outputs
- Precision supply voltage monitor
- Factory programmable Reset Timeout Delay
- Separate Power Fail comparator
- Available in micro SMD package for minimum footprint
- $\pm 0.5\%$  Reset threshold accuracy at room temperature
- $\pm 2\%$  Reset threshold accuracy over temperature extremes
- Reset assertion down to 1V  $V_{CC}$  ( $\overline{\text{RESET}}$  option only)
- 28  $\mu\text{A}$   $V_{CC}$  supply current

## Applications

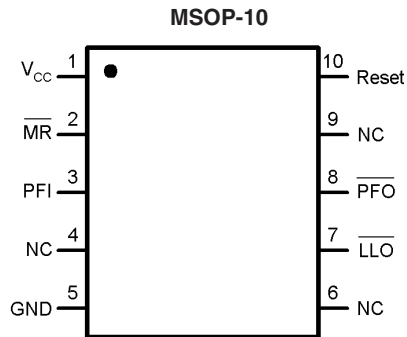
- Embedded Controllers and Processors
- Intelligent Instruments
- Automotive Systems
- Critical  $\mu\text{P}$  Power Monitoring

## Typical Application

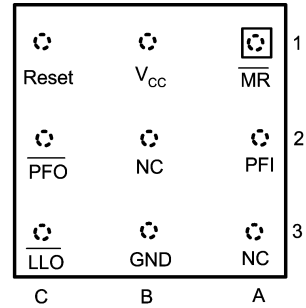


10136903

## Connection Diagram



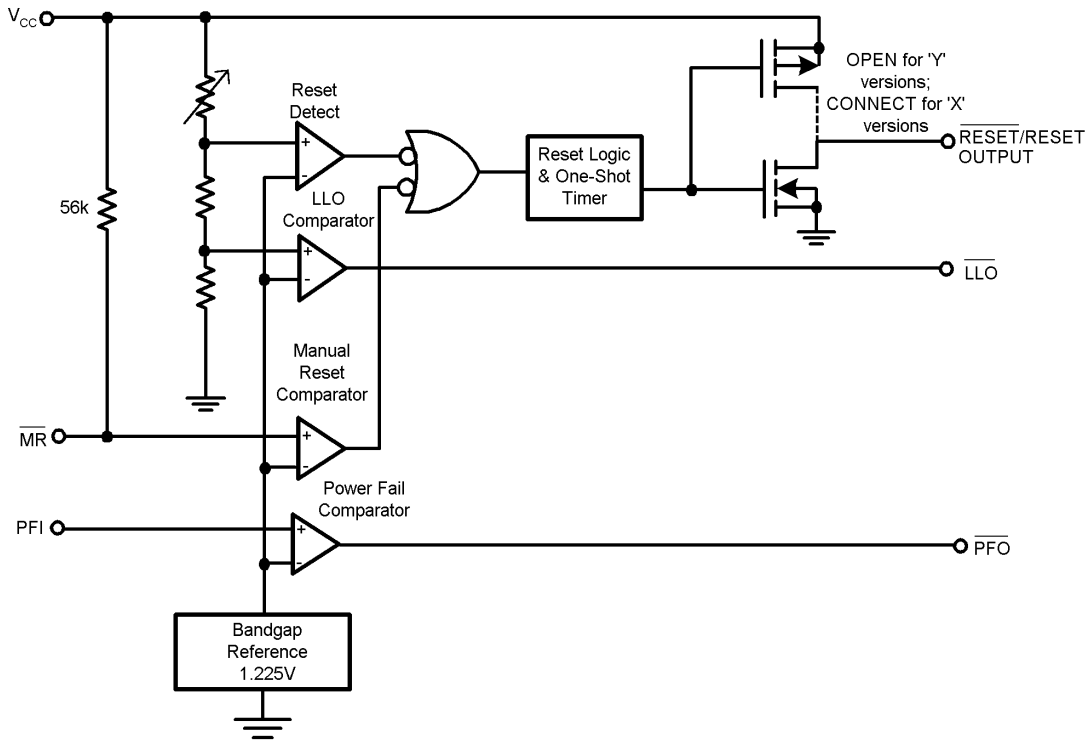
**Top View**  
(looking from the coating side)  
micro SMD 9 Bump Package  
**BPA09**



## Pin Description

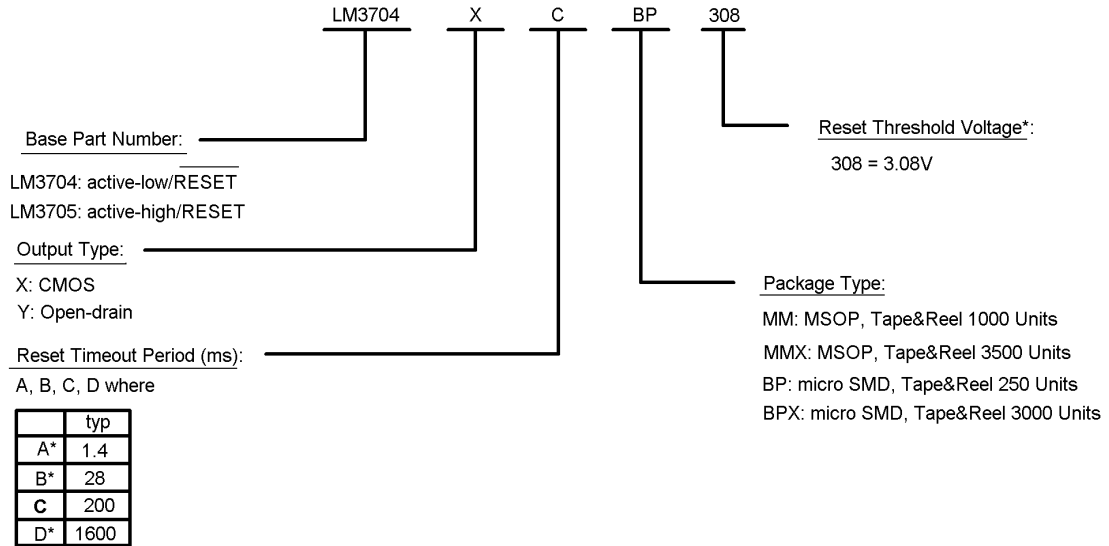
Pin No.		Name	Function
micro SMD	MSOP		
A1	2	$\overline{\text{MR}}$	Manual-Reset input. When $\overline{\text{MR}}$ is less than $V_{\text{MRT}}$ (Manual Reset Threshold) $\overline{\text{RESET}}/\overline{\text{RESET}}$ is engaged.
B1	1	$V_{\text{CC}}$	Power Supply input.
C1	10	$\overline{\text{RESET}}$	Reset Logic Output. Pulses low for $t_{\text{RP}}$ (Reset Timeout Period) when triggered, and stays low whenever $V_{\text{CC}}$ is below the reset threshold or when $\overline{\text{MR}}$ is below $V_{\text{MRT}}$ . It remains low for $t_{\text{RP}}$ after either $V_{\text{CC}}$ rises above the reset threshold, or after $\overline{\text{MR}}$ input rises above $V_{\text{MRT}}$ (LM3704 only).
		RESET	Reset Logic Output. RESET is the inverse of $\overline{\text{RESET}}$ (LM3705 only).
C2	8	$\overline{\text{PFO}}$	Power-Fail Logic Output. When PFI is below $V_{\text{PFT}}$ , $\overline{\text{PFO}}$ goes low; otherwise, $\overline{\text{PFO}}$ remains high.
C3	7	$\overline{\text{LLO}}$	Low-Line Logic Output. Early Power-Fail warning output. Low when $V_{\text{CC}}$ falls below $V_{\text{LLOT}}$ (Low-Line Output Threshold). This output can be used to generate an NMI (Non-Maskable Interrupt) to provide an early warning of imminent power-failure.
B3	5	GND	Ground reference for all signals.
A3	4, 6	NC	No Connect.
A2	3	PFI	Power-Fail Comparator Input. When PFI is less than $V_{\text{PFT}}$ (Power-Fail Reset Threshold), the $\overline{\text{PFO}}$ goes low; otherwise, $\overline{\text{PFO}}$ remains high.
B2	9	NC	No Connect. Test input used at factory only. Leave floating.

### Block Diagram



10136926

## Ordering Information



\* = available upon request. Contact National Semiconductor

\*For other voltages between 2.2V and 5.0V, please contact National Semiconductor sales office.

10136904

### LM3704/LM3705

Part Number	Output	Reset Timeout Period	Package		Package Marking
			MSOP	micro SMD	
LM3704XBBP-232	totem-pole	28ms		x	%I13
LM3704XBBPX-232	totem-pole	28ms		x	%I13
LM3704XBBP-463	totem-pole	28ms		x	%I27
LM3704XBBPX-463	totem-pole	28ms		x	%I27
LM3704XBMM-232	totem-pole	28ms	x		R66B
LM3704XBMMX-232	totem-pole	28ms	x		R66B
LM3704XBMM-463	totem-pole	28ms	x		R27B
LM3704XBMMX-463	totem-pole	28ms	x		R27B
LM3704XCBP-308	totem-pole	200ms		x	%I14
LM3704XCBPX-308	totem-pole	200ms		x	%I14
LM3704XCMM-263	totem-pole	200ms	x		R79B
LM3704XCMMX-263	totem-pole	200ms	x		R79B
LM3704XCMM-308	totem-pole	200ms	x		R35B
LM3704XCMMX-308	totem-pole	200ms	x		R35B
LM3704XDBP-232	totem-pole	1600ms		x	%I15
LM3704XDBPX-232	totem-pole	1600ms		x	%I15
LM3704XDBP-463	totem-pole	1600ms		x	%I17
LM3704XDBPX-463	totem-pole	1600ms		x	%I17
LM3704XDMM-220	totem-pole	1600ms	x		R65B
LM3704XDMMX-220	totem-pole	1600ms	x		R65B
LM3704XDMM-232	totem-pole	1600ms	x		R67B
LM3704XDMMX-232	totem-pole	1600ms	x		R67B
LM3704XDMM-463	totem-pole	1600ms	x		R68B
LM3704XDMMX-463	totem-pole	1600ms	x		R68B
LM3704YAMM-308	open-drain	1.4ms	x		R78B
LM3704YAMMX-308	open-drain	1.4ms	x		R78B

## Ordering Information (Continued)

### LM3704/LM3705 (Continued)

Part Number	Output	Reset Timeout Period	Package		Package Marking
			MSOP	micro SMD	
LM3704YBMM-360	open-drain	28ms	x		R49B
LM3704YBMMX-360	open-drain	28ms	x		R49B
LM3704YCMM-232	open-drain	200ms	x		R76B
LM3704YCMMX-232	open-drain	200ms	x		R76B
LM3704YCMM-308	open-drain	200ms	x		R48B
LM3704YCMMX-308	open-drain	200ms	x		R48B
LM3705XBBP-232	totem-pole	28ms		x	%%I14
LM3705XBBPX-232	totem-pole	28ms		x	%%I14
LM3705XBBP-463	totem-pole	28ms		x	%%I33
LM3705XBBPX-463	totem-pole	28ms		x	%%I33
LM3705XBMM-232	totem-pole	28ms	x		R69B
LM3705XBMMX-232	totem-pole	28ms	x		R69B
LM3705XBMM-463	totem-pole	28ms		x	R44B
LM3705XBMMX-463	totem-pole	28ms		x	R44B
LM3705XCBP-463	totem-pole	200ms		x	%%I5
LM3705XCBPX-463	totem-pole	200ms		x	%%I5
LM3705XCMM-308	totem-pole	200ms	x		R36B
LM3705XCMMX-308	totem-pole	200ms	x		R36B
LM3705XDBP-232	totem-pole	1600ms		x	%%I16
LM3705XDBPX-232	totem-pole	1600ms		x	%%I16
LM3705XDBP-463	totem-pole	1600ms		x	%%I18
LM3705XDBPX-463	totem-pole	1600ms		x	%%I18
LM3705XDMM-232	totem-pole	1600ms	x		R70B
LM3705XDMMX-232	totem-pole	1600ms	x		R70B
LM3705XDMM-463	totem-pole	1600ms	x		R71B
LM3705XDMMX-463	totem-pole	1600ms	x		R71B

%% is the datecode and will vary with time.

## Table of Functions

Part Number	Active Low Reset	Active High Reset	Output (X = totem-pole) (Y = open-drain)	Reset Timeout Period	Manual Reset	Power Fail Comparator	Low Line Output
LM3704	x		X, Y*	Customized	x	x	x
LM3705		x	X	Customized	x	x	x

\* = available upon request. Contact National

**Absolute Maximum Ratings** (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage ( $V_{CC}$ )	-0.3V to 6.0V
All Other Inputs	-0.3V to $V_{CC} + 0.3V$
ESD Ratings (Note 2)	
Human Body Model	1.5kV
Machine Model	150V

Power Dissipation

(Note 3)

**Operating Ratings** (Note 1)

Temperature Range

 $-40^{\circ}\text{C} \leq T_J \leq 85^{\circ}\text{C}$ **LM3704/LM3705 Series Electrical Characteristics**

Limits in the standard typeface are for  $T_J = 25^{\circ}\text{C}$  and limits in **boldface type** apply over full operating range. Unless otherwise specified:  $V_{CC} = +2.2V$  to  $5.5V$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>POWER SUPPLY</b>						
$V_{CC}$	Operating Voltage Range: $V_{CC}$	LM3704	<b>1.0</b>		<b>5.5</b>	V
		LM3705	<b>1.2</b>		<b>5.5</b>	
$I_{CC}$	$V_{CC}$ Supply Current	All inputs = $V_{CC}$ ; all outputs floating		28	<b>50</b>	$\mu\text{A}$
<b>RESET THRESHOLD</b>						
$V_{RST}$	Reset Threshold	$V_{CC}$ falling	-0.5 <b>-2</b>	$V_{RST}$	+0.5 <b>+2</b>	%
		$V_{CC}$ falling: $T_A = 0^{\circ}\text{C}$ to $70^{\circ}\text{C}$	<b>-1.5</b>		<b>+1.5</b>	
$V_{RSTH}$	Reset Threshold Hysteresis			$0.0032 \cdot V_{RST}$		mV
$t_{RP}$	Reset Timeout Period	Reset Timeout Period = A	<b>1</b>	1.4	<b>2</b>	ms
		Reset Timeout Period = B	<b>20</b>	28	<b>40</b>	
		Reset Timeout Period = C	<b>140</b>	200	<b>280</b>	
		Reset Timeout Period = D	<b>1120</b>	1600	<b>2240</b>	
$t_{RD}$	$V_{CC}$ to Reset Delay	$V_{CC}$ falling at $1\text{mV}/\mu\text{s}$		20		$\mu\text{s}$
<b>RESET (LM3705)</b>						
$V_{OL}$	RESET	$V_{CC} > 2.25V$ , $I_{SINK} = 900\mu\text{A}$			<b>0.3</b>	V
		$V_{CC} > 2.7V$ , $I_{SINK} = 1.2\text{mA}$			<b>0.3</b>	
		$V_{CC} > 4.5V$ , $I_{SINK} = 3.2\text{mA}$			<b>0.4</b>	
$V_{OH}$	RESET	$V_{CC} > 1.2V$ , $I_{SOURCE} = 50\mu\text{A}$	<b><math>0.8 V_{CC}</math></b>			V
		$V_{CC} > 1.8V$ , $I_{SOURCE} = 150\mu\text{A}$	<b><math>0.8 V_{CC}</math></b>			
		$V_{CC} > 2.25V$ , $I_{SOURCE} = 300\mu\text{A}$	<b><math>0.8 V_{CC}</math></b>			
		$V_{CC} > 2.7V$ , $I_{SOURCE} = 500\mu\text{A}$	<b><math>0.8 V_{CC}</math></b>			
		$V_{CC} > 4.5V$ , $I_{SOURCE} = 800\mu\text{A}$	<b><math>V_{CC} - 1.5V</math></b>			
$I_{LKG}$	Output Leakage Current	$V_{RESET} = 5.5V$			<b>1.0</b>	$\mu\text{A}$
<b>RESET (LM3704)</b>						
$V_{OL}$	$\overline{\text{RESET}}$	$V_{CC} > 1.0V$ , $I_{SINK} = 50\mu\text{A}$			<b>0.3</b>	V
		$V_{CC} > 1.2V$ , $I_{SINK} = 100\mu\text{A}$			<b>0.3</b>	
		$V_{CC} > 2.25V$ , $I_{SINK} = 900\mu\text{A}$			<b>0.3</b>	
		$V_{CC} > 2.7V$ , $I_{SINK} = 1.2\text{mA}$			<b>0.3</b>	
		$V_{CC} > 4.5V$ , $I_{SINK} = 3.2\text{mA}$			<b>0.4</b>	
$V_{OH}$	$\overline{\text{RESET}}$	$V_{CC} > 2.25V$ , $I_{SOURCE} = 300\mu\text{A}$	<b><math>0.8 V_{CC}</math></b>			V
		$V_{CC} > 2.7V$ , $I_{SOURCE} = 500\mu\text{A}$	<b><math>0.8 V_{CC}</math></b>			
		$V_{CC} > 4.5V$ , $I_{SOURCE} = 800\mu\text{A}$	<b><math>V_{CC} - 1.5V</math></b>			

## LM3704/LM3705 Series Electrical Characteristics (Continued)

Limits in the standard typeface are for  $T_J = 25^\circ\text{C}$  and limits in **boldface type** apply over full operating range. Unless otherwise specified:  $V_{CC} = +2.2\text{V}$  to  $5.5\text{V}$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>PFI/MR</b>						
$V_{PFT}$	PFI Input Threshold		<b>1.200</b>	1.225	<b>1.250</b>	V
$V_{MRT}$	MR Input Threshold	MR, Low			<b>0.8</b>	V
		MR, High	<b>2.0</b>			
$V_{PFTH}/V_{MRTH}$	PFI/MR Threshold Hysteresis	PFI/MR falling: $V_{CC} = V_{RST\ MAX}$ to $5.5\text{V}$		$0.0032 \cdot V_{RST}$		mV
$I_{PFI}$	Input Current (PFI only)		<b>-75</b>		<b>75</b>	nA
$R_{MR}$	MR Pull-up Resistance		<b>35</b>	56	<b>75</b>	k $\Omega$
$t_{MD}$	MR to Reset Delay			12		$\mu\text{s}$
$t_{MR}$	MR Pulse Width		<b>25</b>			$\mu\text{s}$
<b>PFO, LLO</b>						
$V_{OL}$	PFO, LLO Output Voltage	$V_{CC} > 2.25\text{V}$ , $I_{SINK} = 900\mu\text{A}$			<b>0.3</b>	V
		$V_{CC} > 2.7\text{V}$ , $I_{SINK} = 1.2\text{mA}$			<b>0.3</b>	
		$V_{CC} > 4.5\text{V}$ , $I_{SINK} = 3.2\text{mA}$			<b>0.4</b>	
$V_{OH}$		$V_{CC} > 2.25\text{V}$ , $I_{SOURCE} = 300\mu\text{A}$	<b>0.8 <math>V_{CC}</math></b>			V
		$V_{CC} > 2.7\text{V}$ , $I_{SOURCE} = 500\mu\text{A}$	<b>0.8 <math>V_{CC}</math></b>			
		$V_{CC} > 4.5\text{V}$ , $I_{SOURCE} = 800\mu\text{A}$	<b><math>V_{CC} - 1.5\text{V}</math></b>			
<b>LLO OUTPUT</b>						
$V_{LLOT}$	LLO Output Threshold (V <sub>LLO</sub> - V <sub>RST</sub> , V <sub>CC</sub> falling)		<b>1.01 • V<sub>RST</sub></b>	1.02 • V <sub>RST</sub>	<b>1.03 • V<sub>RST</sub></b>	V
$V_{LLOTH}$	Low-Line Comparator Hysteresis			$0.0032 \cdot V_{RST}$		mV
$t_{CD}$	Low-Line Comparator Delay	$V_{CC}$ falling at $1\text{mV}/\mu\text{s}$		20		$\mu\text{s}$

**Note 1: Absolute Maximum Ratings** indicate limits beyond which damage to the device may occur. **Operating Ratings** indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed conditions.

**Note 2:** The Human Body model is a 100 pF capacitor discharged through a 1.5 k $\Omega$  resistor into each pin. The machine model is a 200pF capacitor discharged directly into each pin.

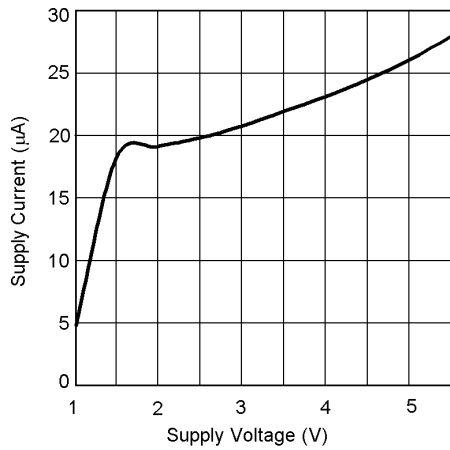
**Note 3:** The maximum allowable power dissipation is a function of the maximum junction temperature,  $T_J(\text{MAX})$ , the junction-to-ambient thermal resistance,  $\theta_{JA}$ , and the ambient temperature,  $T_A$ . The maximum allowable power dissipation at any ambient temperature is calculated using:

$$P(\text{MAX}) = \frac{T_J(\text{MAX}) - T_A}{\theta_{JA}}$$

Where the value of  $\theta_{JA}$  for the MSOP-10 package is 195°C/W in a typical PC board mounting and the micro SMD package is 220°C/W.

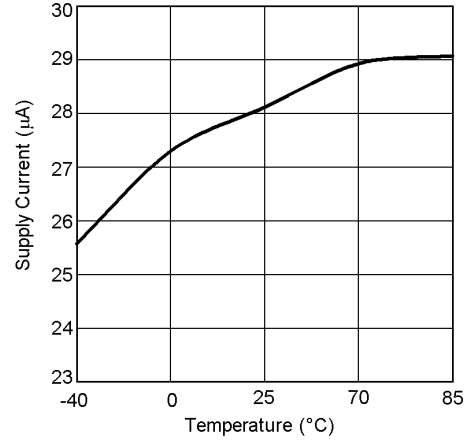
# Typical Performance Characteristics

Supply Current vs Supply Voltage



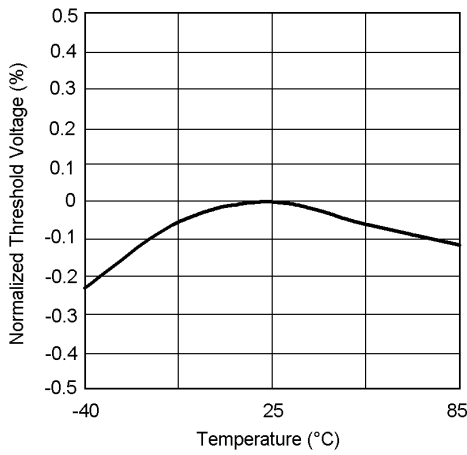
10136915

3.3V Supply Current vs Temperature



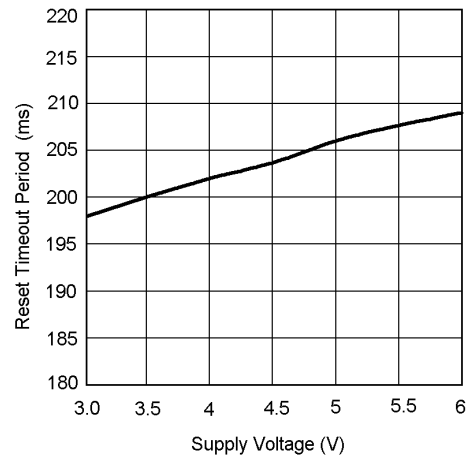
10136911

Normalized Reset Threshold Voltage vs Temperature



10136912

Reset Timeout Period vs V<sub>CC</sub>



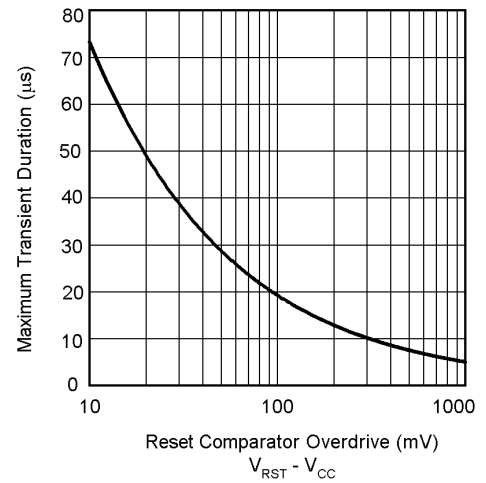
10136932

Reset Timeout Period vs Temperature



10136910

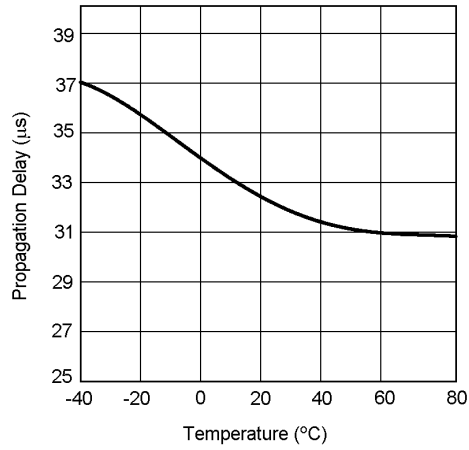
Max. Transient Duration vs Reset Comparator Overdrive (V<sub>CC</sub> = 3.3V)



10136916

# Typical Performance Characteristics (Continued)

## Low-Line Comparator Propagation Delay vs Temperature



10136914

## Circuit Information

### RESET OUTPUT

The Reset input of a  $\mu\text{P}$  initializes the device into a known state. The LM3704/LM3705 microprocessor supervisory circuits assert a forced reset output to prevent code execution errors during power-up, power-down, and brownout conditions.

$\overline{\text{RESET}}$  is guaranteed valid for  $V_{\text{CC}} > 1\text{V}$ . Once  $V_{\text{CC}}$  exceeds the reset threshold, an internal timer maintains the output for the reset timeout period. After this interval, reset goes high. The LM3704 offers an active-low  $\overline{\text{RESET}}$ ; The LM3705 offers an active-high RESET.

Any time  $V_{\text{CC}}$  drops below the reset threshold (such as during a brownout), the reset activates. When  $V_{\text{CC}}$  again rises above the reset threshold, the internal timer starts. Reset holds until  $V_{\text{CC}}$  exceeds the reset threshold for longer than the reset timeout period. After this time, reset releases.

The Manual Reset input ( $\overline{\text{MR}}$ ) will initiate a forced reset also. See the *Manual Reset Input* section.

### RESET THRESHOLD

The LM3704/LM3705 family is available with a reset voltage of 3.08V. Other reset thresholds in the 2.20V to 5.0V range, in steps of 10 mV, are available; contact National Semiconductor for details.

### MANUAL RESET INPUT ( $\overline{\text{MR}}$ )

Many  $\mu\text{P}$ -based products require a manual reset capability, allowing the operator to initiate a reset. The  $\overline{\text{MR}}$  input is fully debounced and provides an internal 56 k $\Omega$  pull-up. When the  $\overline{\text{MR}}$  input is pulled below  $V_{\text{MRT}}$  (1.225V) for more than 25  $\mu\text{s}$ , reset is asserted after a typical delay of 12  $\mu\text{s}$ . Reset remains active as long as  $\overline{\text{MR}}$  is held low, and releases after the reset timeout period expires after  $\overline{\text{MR}}$  rises above  $V_{\text{MRT}}$ . Use  $\overline{\text{MR}}$  with digital logic to assert or to daisy chain supervisory circuits. It may be used as another low-line comparator by adding a buffer.

### POWER-FAIL COMPARATOR (PFI/ $\overline{\text{PFO}}$ )

The PFI is compared to a 1.225V internal reference,  $V_{\text{PFT}}$ . If PFI is less than  $V_{\text{PFT}}$ , the Power Fail Output  $\overline{\text{PFO}}$  drops low. The power-fail comparator signals a falling power supply, and is driven typically by an external voltage divider that senses either the unregulated supply or another system

supply voltage. The voltage divider generally is chosen so the voltage at PFI drops below  $V_{\text{PFT}}$  several milliseconds before the main supply voltage drops below the reset threshold, providing advanced warning of a brownout.

The voltage threshold is set by  $R_1$  and  $R_2$  and is calculated as follows:

$$V_{\text{PFT}} = \left( \frac{R_1 + R_2}{R_2} \right) \times 1.225\text{V}$$

Note this comparator is completely separate from the rest of the circuitry, and may be employed for other functions as needed.

### LOW-LINE OUTPUT ( $\overline{\text{LLO}}$ )

The low-line output comparator is typically used to provide a non-maskable interrupt to a  $\mu\text{P}$  when  $V_{\text{CC}}$  begins falling.  $\overline{\text{LLO}}$  monitors  $V_{\text{CC}}$  and goes low when  $V_{\text{CC}}$  falls below  $V_{\text{LLOT}}$  (typically  $1.02 \cdot V_{\text{RST}}$ ) with hysteresis of  $0.0032 \cdot V_{\text{RST}}$ .

### SPECIAL PRECAUTIONS FOR THE MICRO SMD PACKAGE

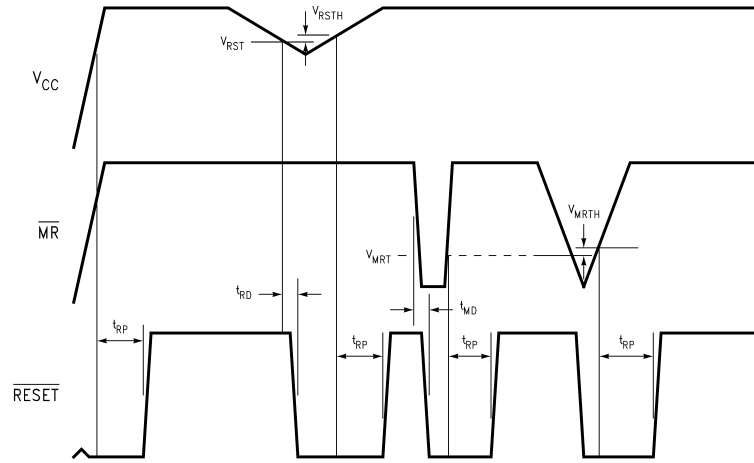
As with most integrated circuits, the LM3704 and LM3705 are sensitive to exposure from visible and infrared (IR) light radiation. Unlike a plastic encapsulated IC, the micro SMD package has very limited shielding from light, and some sensitivity to light reflected from the surface of the PC board or long wavelength IR entering the die from the side may be experienced. This light could have an unpredictable affect on the electrical performance of the IC. Care should be taken to shield the device from direct exposure to bright visible or IR light during operation.

### MICRO SMD MOUNTING

The micro SMD package requires specific mounting techniques which are detailed in National Semiconductor Application Note AN-1112. Referring to the section **Surface Mount Technology (SMT) Assembly Considerations**, it should be noted that the pad style which must be used with the 9-pin package is the NSMD (non-solder mask defined) type.

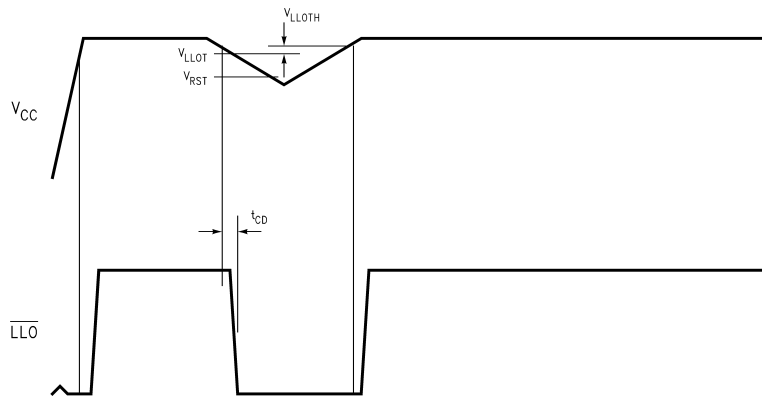
For best results during assembly, alignment ordinals on the PC board may be used to facilitate placement of the micro SMD device.

# Timing Diagrams



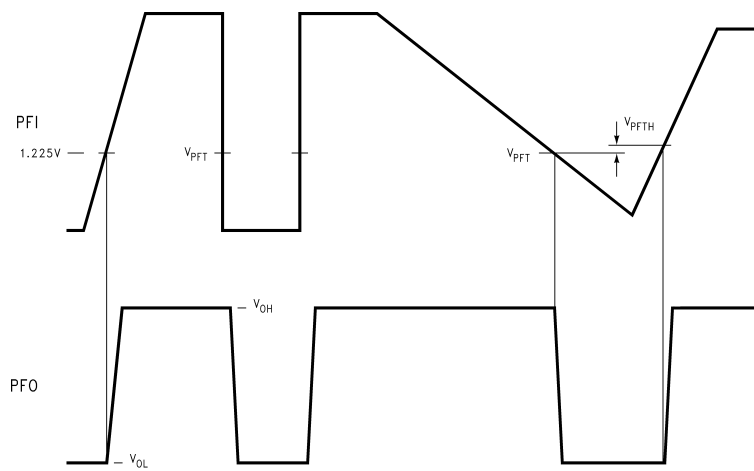
10136928

FIGURE 1. LM3704 Reset Time with  $\overline{MR}$



10136929

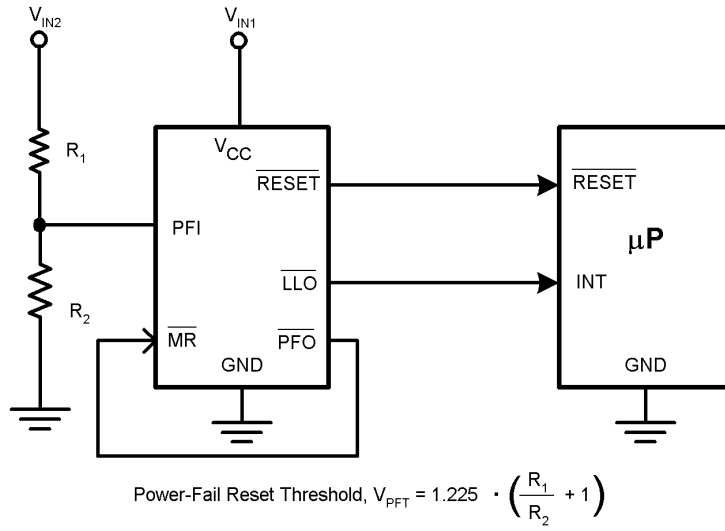
FIGURE 2.  $\overline{LLO}$  Output



10136930

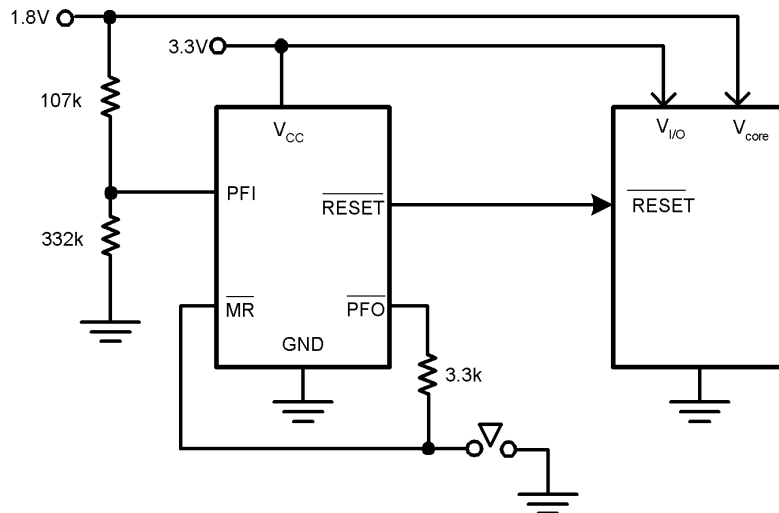
FIGURE 3. PFI Comparator Timing Diagram

## Typical Application Circuits



10136918

FIGURE 4. Monitoring Two Critical Supplies



10136919

FIGURE 5. Monitoring Two Supplies plus Manual Reset

Typical Application Circuits (Continued)

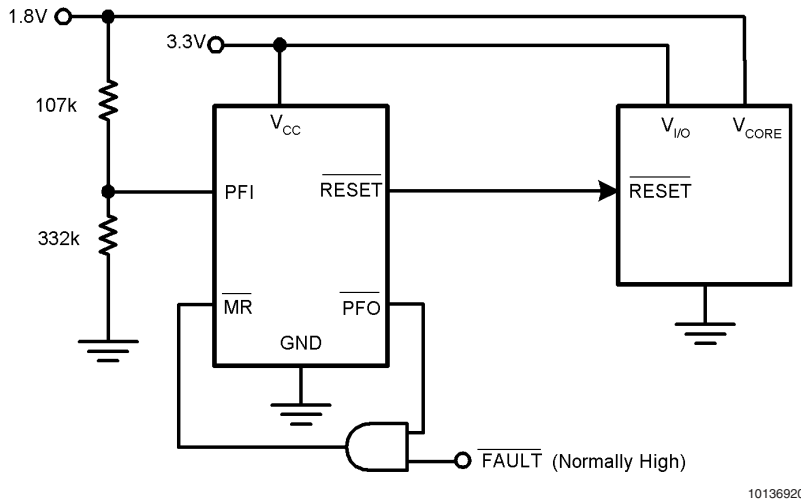
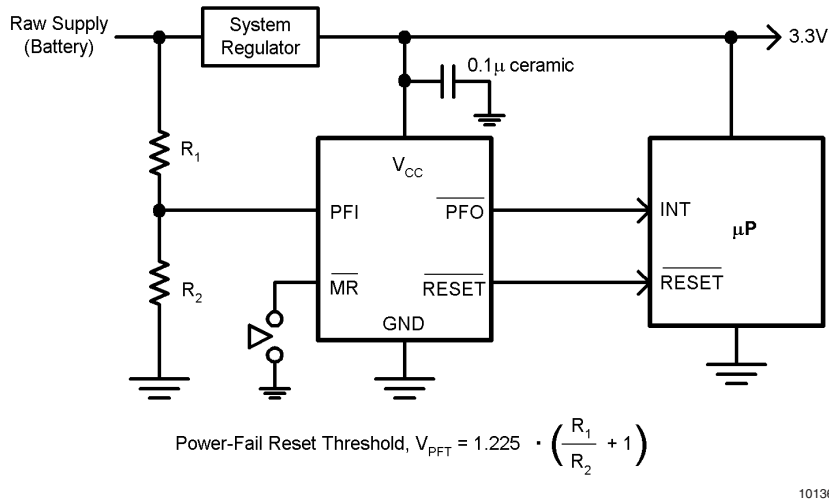


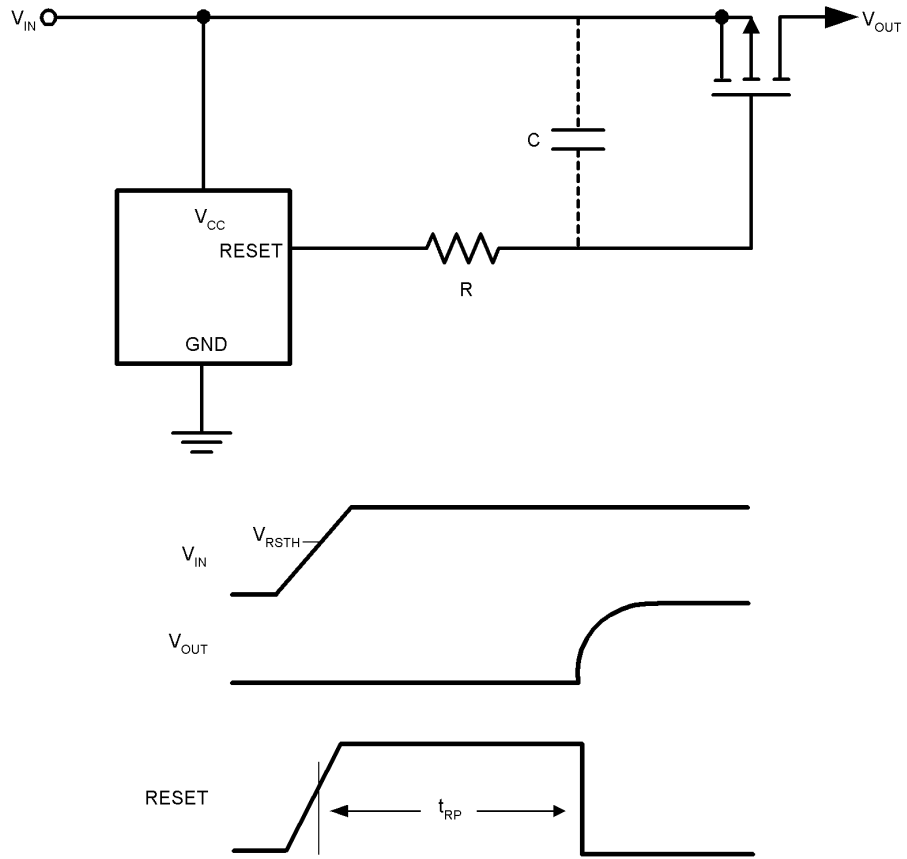
FIGURE 6. Monitoring Dual Supplies plus External Fault Input



Note:  $\overline{MR}$  input with its 1.225V nominal threshold, may monitor an additional supply voltage. An internal 56 kΩ pull-up resistor is included on this input.

FIGURE 7. Microprocessor Supervisor with Early Warning Detector

Typical Application Circuits (Continued)



10136924

FIGURE 8. LM3705 Power-On Delay

Typical Application Circuits (Continued)

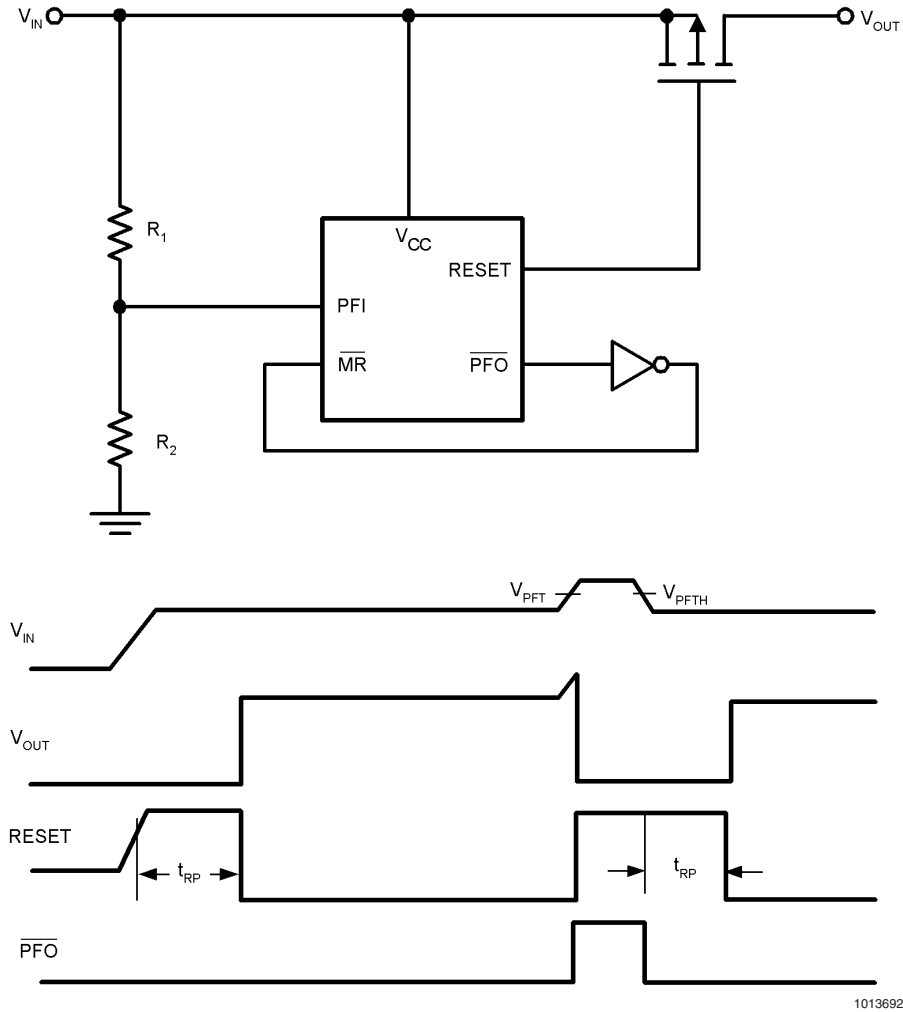


FIGURE 9. LM3705 Power-On Delay with Overvoltage Protection

10136923

Typical Application Circuits (Continued)



FIGURE 10. Regulator/Switch with Long-Term Overvoltage Lockout Prevents Overdissipation in Linear Regulator

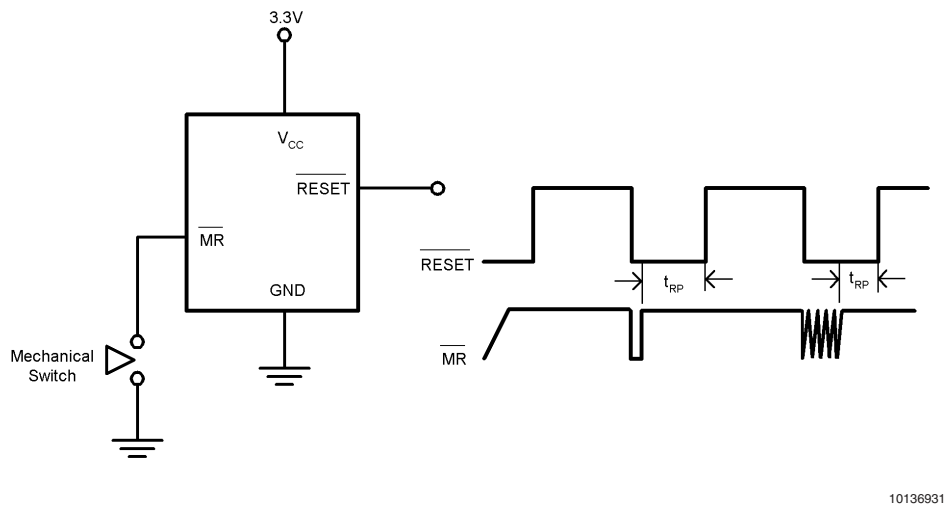
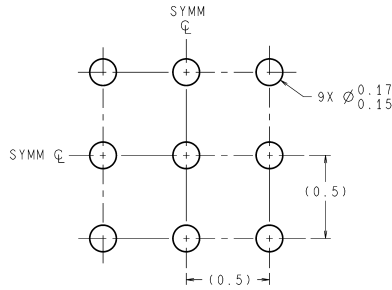


FIGURE 11. Switch Debouncer

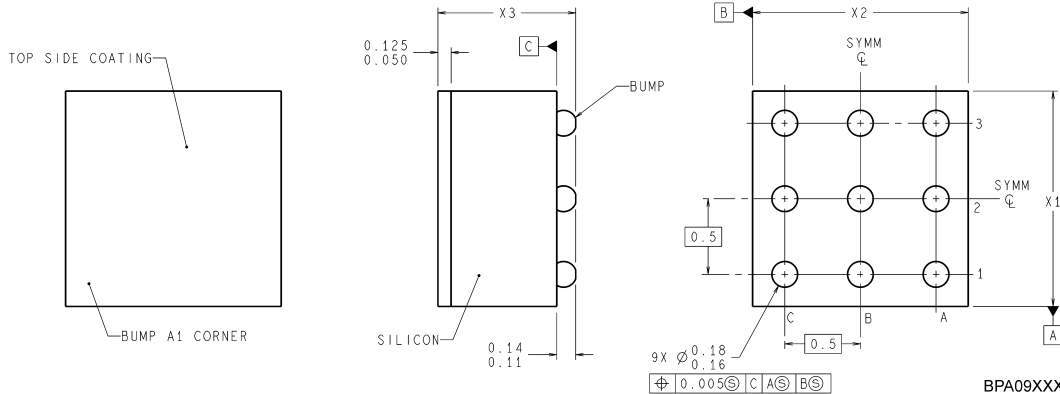


## Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



DIMENSIONS ARE IN MILLIMETERS

### LAND PATTERN RECOMMENDATION



BPA09XXX (Rev D)

NOTES: UNLESS OTHERWISE SPECIFIED

1. EPOXY COATING
2. 63Sn/37Pb EUTECTIC BUMP
3. RECOMMEND NON-SOLDER MASK DEFINED LANDING PAD.
4. PIN 1 IS ESTABLISHED BY LOWER LEFT CORNER WITH RESPECT TO TEXT ORIENTATION. REMAINING PINS ARE NUMBERED COUNTER CLOCKWISE.
5. XXX IN DRAWING NUMBER REPRESENTS PACKAGE SIZE VARIATION WHERE X1 IS PACKAGE WIDTH, X2 IS PACKAGE LENGTH AND X3 IS PACKAGE HEIGHT.
6. NO JEDEC REGISTRATION AS OF AUG.1999.

**9 bump micro SMD Package  
NS Package Number BPA09FFB  
The dimensions of X1, X2 and X3 are given below**

**X1 = 1.412mm  
X2 = 1.412mm  
X3 = 0.850mm**

### LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



**National Semiconductor**  
Americas Customer  
Support Center  
Email: new.feedback@nsc.com  
Tel: 1-800-272-9959

www.national.com

**National Semiconductor**  
Europe Customer Support Center  
Fax: +49 (0) 180-530 85 86  
Email: europe.support@nsc.com  
Deutsch Tel: +49 (0) 69 9508 6208  
English Tel: +44 (0) 870 24 0 2171  
Français Tel: +33 (0) 1 41 91 8790

**National Semiconductor**  
Asia Pacific Customer  
Support Center  
Email: ap.support@nsc.com

**National Semiconductor**  
Japan Customer Support Center  
Fax: 81-3-5639-7507  
Email: jpn.feedback@nsc.com  
Tel: 81-3-5639-7560

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Mobile Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Transportation and Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

TI E2E Community Home Page

[e2e.ti.com](http://e2e.ti.com)

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2011, Texas Instruments Incorporated

## Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View LM3704XCMMX-263](#) on WIN SOURCE

 [Texas Instruments](#) Information

## Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management