LM3700, LM3701

LM3700/LM3701 Microprocessor Supervisory Circuit with Low Line Output

Check for Samples: LM3700, LM3701

FEATURES

- **Standard Reset Threshold Voltage: 3.08V**
- **Custom Reset Threshold Voltages: For Other Voltages between 2.2V and 5.0V in 10mV Increments, Contact Texas Instruments.**
- **No External Components Required**
- **$\overline{\text{RESET}}$ (LM3700) or RESET (LM3701) Outputs**
- **Precision Supply Voltage Monitor**
- **Factory Programmable Reset Timeout Delay**
- **Available in micro SMD Package for Minimum Footprint**
- **±0.5% Reset Threshold Accuracy at Room Temperature**
- **±2% Reset Threshold Accuracy Over Temperature Extremes**
- **Reset Assertion Down to 1V V_{CC} ($\overline{\text{RESET}}$ Option Only)**
- **28 µA V_{CC} Supply Current**

APPLICATIONS

- **Embedded Controllers and Processors**
- **Intelligent Instruments**
- **Automotive Systems**
- **Critical µP Power Monitoring**

DESCRIPTION

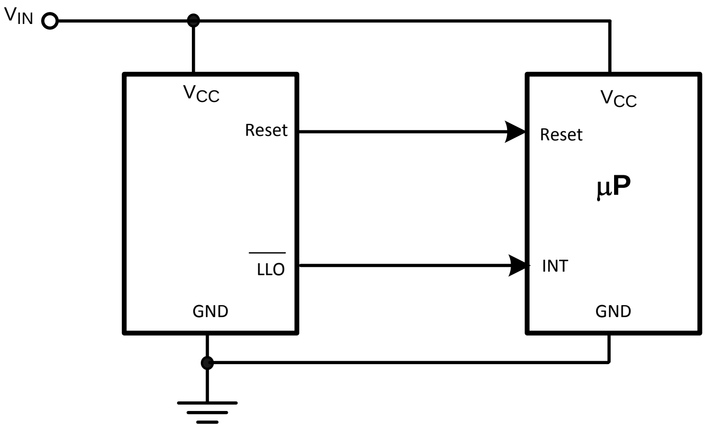
The LM3700/LM3701 series of microprocessor supervisory circuits provide the maximum flexibility for monitoring power supplies and battery controlled functions in systems without backup batteries. The LM3700/LM3701 series are available in a 9-bump micro SMD package.

Built-in features include the following:

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

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.

Typical Application



Connection Diagram

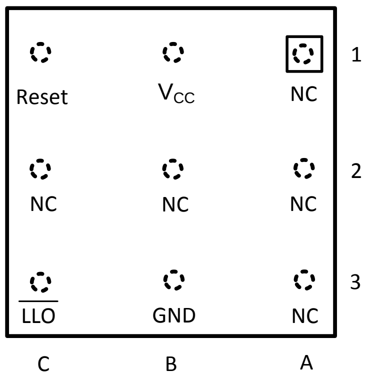


**Figure 1. Top View (looking from the coating side)
micro SMD 9 Bump Package
BPA09**

Table 1. PIN DESCRIPTIONS

Bump No.	Name	Function
B1	V_{CC}	Power Supply input.
C1	$\overline{\text{RESET}}$	Reset Logic Output. Pulses low for t_{RP} (Reset Timeout Period) when triggered, and stays low whenever V_{CC} is below the reset threshold or when $\overline{\text{MR}}$ is below V_{MRT}. It remains low for t_{RP} after either V_{CC} rises above the reset threshold, or after $\overline{\text{MR}}$ input rises above V_{MRT} (LM3700 only).
	RESET	Reset Logic Output. RESET is the inverse of $\overline{\text{RESET}}$ (LM3701 only).
C3	$\overline{\text{LLO}}$	Low-Line Logic Output. Early Power-Fail warning output. Low when V_{CC} falls below V_{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	GND	Ground reference for all signals.
A1, A2, A3, C2	NC	No Connect.
B2	NC	No Connect. Test input used at factory only. Leave floating.

Block Diagram

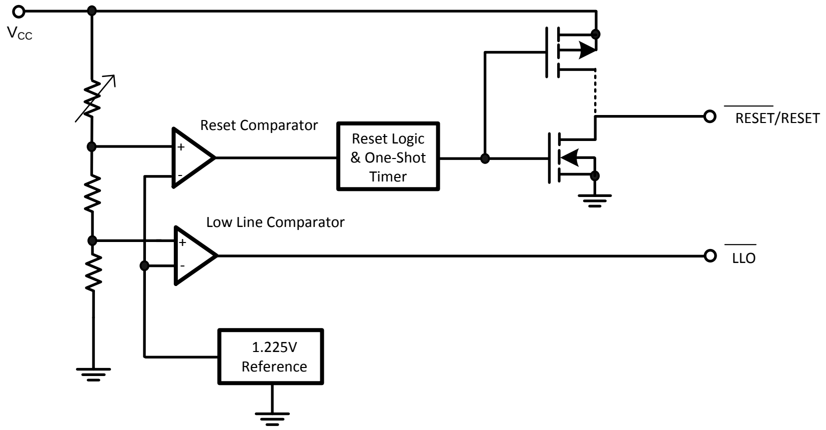


Table 2. Table Of Functions

Part Number	Active Low Reset	Active High Reset	Output (X = totem-pole) (Y = open-drain)	Reset Timeout Period	Low Line Output
LM3700	x		X, Y[(1)]	Customized	x
LM3701		x	X	Customized	x

(1) = available upon request. Contact TI

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)(2)]

Supply Voltage (V_{CC})		−0.3V to 6.0V
All Other Inputs		−0.3V to V_{CC} + 0.3V
ESD Ratings[(3)]	Human Body Model	1.5kV
	Machine Model	150V
Power Dissipation		See[(4)]

(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 ensure specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics. The ensured specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed conditions.

(2) If Military/Aerospace specified devices are required, please contact the TI Sales Office/ Distributors for availability and specifications.

(3) The Human Body model is a 100 pF capacitor discharged through a 1.5 kΩ resistor into each pin. The machine model is a 200pF capacitor discharged directly into each pin.

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

$$P(MAX) = \frac{T_J(MAX) - T_A}{\theta_{J-A}}$$

Where the value of $\theta_{J\text{-}A}$ for the micro SMD package is 220°C/W.

OPERATING RATINGS[(1)]

Temperature Range	$-40°C \le T_J \le 85°C$

(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 ensure specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics. The ensured specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed conditions.

LM3700/LM3701 SERIES ELECTRICAL CHARACTERISTICS

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

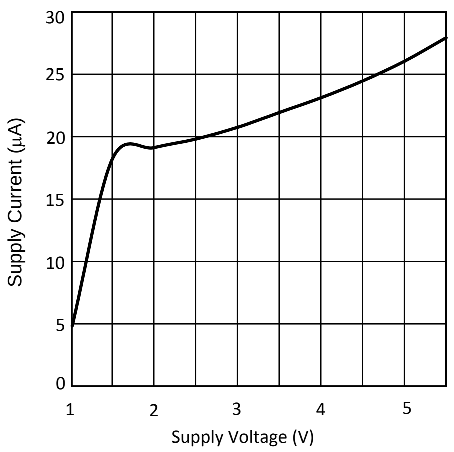
Symbol	Parameter	Conditions	Min	Typ	Max	Units
POWER SUPPLY						
V_{CC}	Operating Voltage Range: V_{CC}	LM3700	**1.0**		**5.5**	V
		LM3701	**1.2**		**5.5**	
I_{CC}	V_{CC} Supply Current	All inputs = V_{CC}; all outputs floating		28	**50**	µA
RESET THRESHOLD						
V_{RST}	Reset Threshold	V_{CC} falling	−0.5 **−2**	V_{RST}	+0.5 **+2**	%
		V_{CC} falling: T_A = 0°C to 70°C	**−1.5**		**+1.5**	
V_{RSTH}	Reset Threshold Hysteresis			0.0032•V_{RST}		mV
t_{RP}	Reset Timeout Period	Reset Timeout Period = A Reset Timeout Period = B Reset Timeout Period = C Reset Timeout Period = D	**1** **20** **140** **1120**	1.4 28 200 1600	**2** **40** **280** **2240**	ms
t_{RD}	$V_{CC}$to Reset Delay	V_{CC} falling at 1mV/µs		20		µs

LM3700/LM3701 SERIES ELECTRICAL CHARACTERISTICS (continued)

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

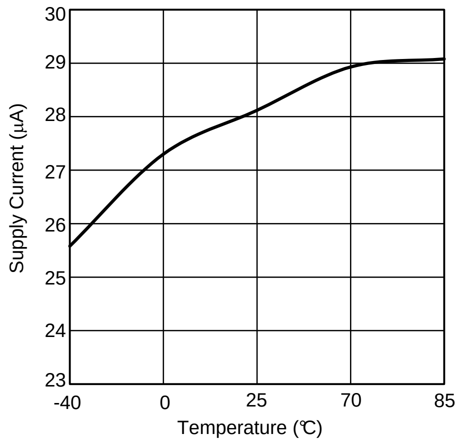
Symbol	Parameter	Conditions	Min	Typ	Max	Units
RESET (LM3701)						
V_{OL}	RESET	V_{CC} > 2.25V, I_{SINK} = 900µA			**0.3**	V
		V_{CC} > 2.7V, I_{SINK} = 1.2mA			**0.3**	
		V_{CC} > 4.5V, I_{SINK} = 3.2mA			**0.4**	
V_{OH}	RESET	V_{CC} > 1.2V, I_{SOURCE} = 50µA	**0.8 V_{CC}**			V
		V_{CC} > 1.8V, I_{SOURCE} = 150µA	**0.8 V_{CC}**			
		V_{CC} > 2.25V, I_{SOURCE} = 300µA	**0.8 V_{CC}**			
		V_{CC} > 2.7V, I_{SOURCE} = 500µA	**0.8 V_{CC}**			
		V_{CC} > 4.5V, I_{SOURCE} = 800µA	**V_{CC} − 1.5V**			
I_{LKG}	Output Leakage Current	V_{RESET} = 5.5V			**1.0**	µA
$\overline{\text{RESET}}$ (LM3700)						
V_{OL}	$\overline{\text{RESET}}$	V_{CC} > 1.0V, I_{SINK} = 50µA			**0.3**	V
		V_{CC} > 1.2V, I_{SINK} = 100µA			**0.3**	
		V_{CC} > 2.25V, I_{SINK} = 900µA			**0.3**	
		V_{CC} > 2.7V, I_{SINK} = 1.2mA			**0.3**	
		V_{CC} > 4.5V, I_{SINK} = 3.2mA			**0.4**	
V_{OH}	$\overline{\text{RESET}}$	V_{CC} > 2.25V, I_{SOURCE} = 300µA	**0.8 V_{CC}**			
		V_{CC} > 2.7V, I_{SOURCE} = 500µA	**0.8 V_{CC}**			
		V_{CC} > 4.5V, I_{SOURCE} = 800µA	**V_{CC} − 1.5V**			
$\overline{\text{LLO}}$						
V_{OL}	$\overline{\text{LLO}}$ Output Voltage	V_{CC} > 2.25V, I_{SINK} = 900µA			**0.3**	V
		V_{CC} > 2.7V, I_{SINK} = 1.2mA			**0.3**	
		V_{CC} > 4.5V, I_{SINK} = 3.2mA			**0.4**	
V_{OH}		V_{CC} > 2.25V, I_{SOURCE} = 300µA	**0.8 V_{CC}**			
		V_{CC} > 2.7V, I_{SOURCE} = 500µA	**0.8 V_{CC}**			
		V_{CC} > 4.5V, I_{SOURCE} = 800µA	**V_{CC} − 1.5V**			
$\overline{\text{LLO}}$ OUTPUT						
V_{LLOT}	$\overline{\text{LLO}}$ Output Threshold ($V_{\overline{\text{LLO}}} - V_{RST}$, V_{CC} falling)		**1.01•V_{RST}**	1.02•V_{RST}	**1.03•V_{RST}**	V
V_{LLOTH}	Low-Line Comparator Hysteresis			0.0032•V_{RST}		mV
t_{CD}	Low-Line Comparator Delay	V_{CC} falling at 1mV/µs		20		µs

TYPICAL PERFORMANCE CHARACTERISTICS



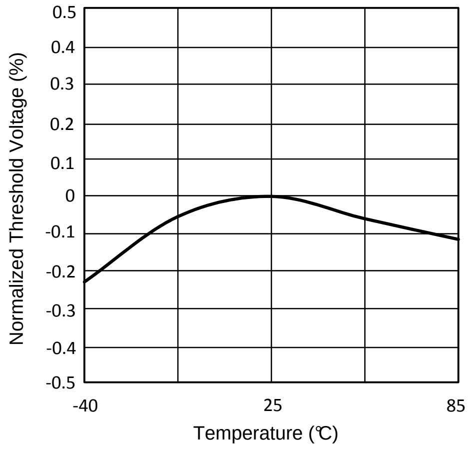
Supply Current vs Supply Voltage

Figure 2.



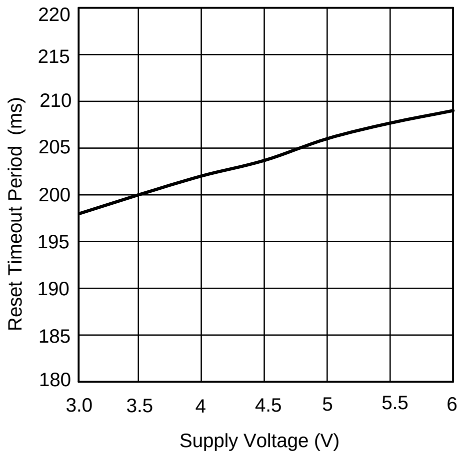
3.3V Supply Current vs Temperature

Figure 3.



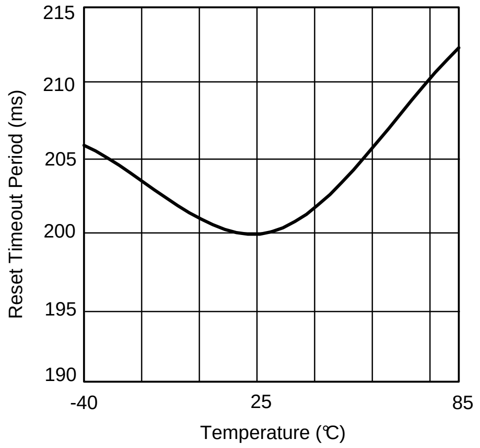
Normalized Reset Threshold Voltage vs Temperature

Figure 4.



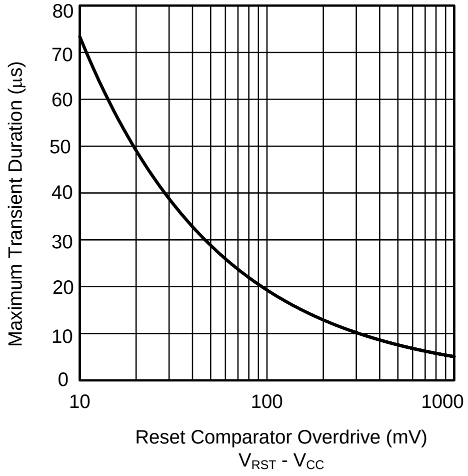
Reset Timeout Period vs V_{CC}

Figure 5.



Reset Timeout Period vs Temperature

Figure 6.



Max. Transient Duration vs Reset Comparator Overdrive (V_{CC} = 3.3V)

Figure 7.

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

Low-Line Comparator Propagation Delay vs Temperature

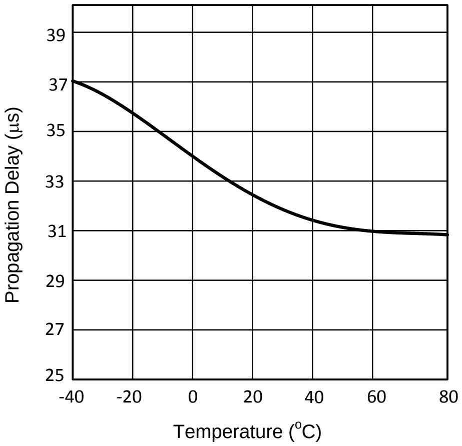


Figure 8.

CIRCUIT INFORMATION

RESET OUTPUT

The Reset input of a µP initializes the device into a known state. The LM3700/LM3701 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 ensured valid for V_{CC} > 1V. Once V_{CC} exceeds the reset threshold, an internal timer maintains the output for the reset timeout period. After this interval, reset goes high. The LM3700 offers an active-low $\overline{\text{RESET}}$; The LM3701 offers an active-high RESET.

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

RESET THRESHOLD

The LM3700/LM3701 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 TI for details.

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

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

SPECIAL PRECAUTIONS FOR THE MICRO SMD PACKAGE

As with most integrated circuits, the LM3700 and LM3701 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 TI 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

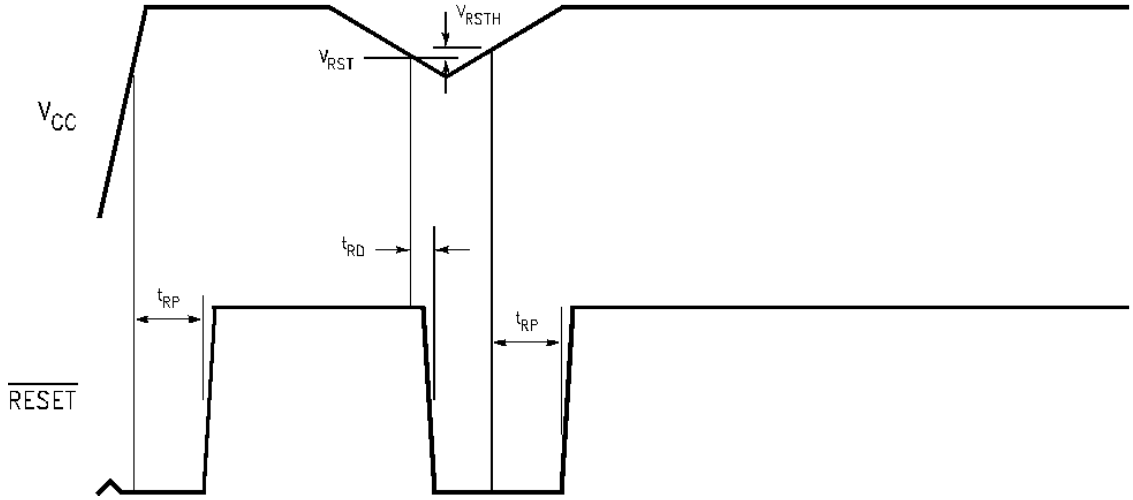


Figure 9. LM3700 Reset Time

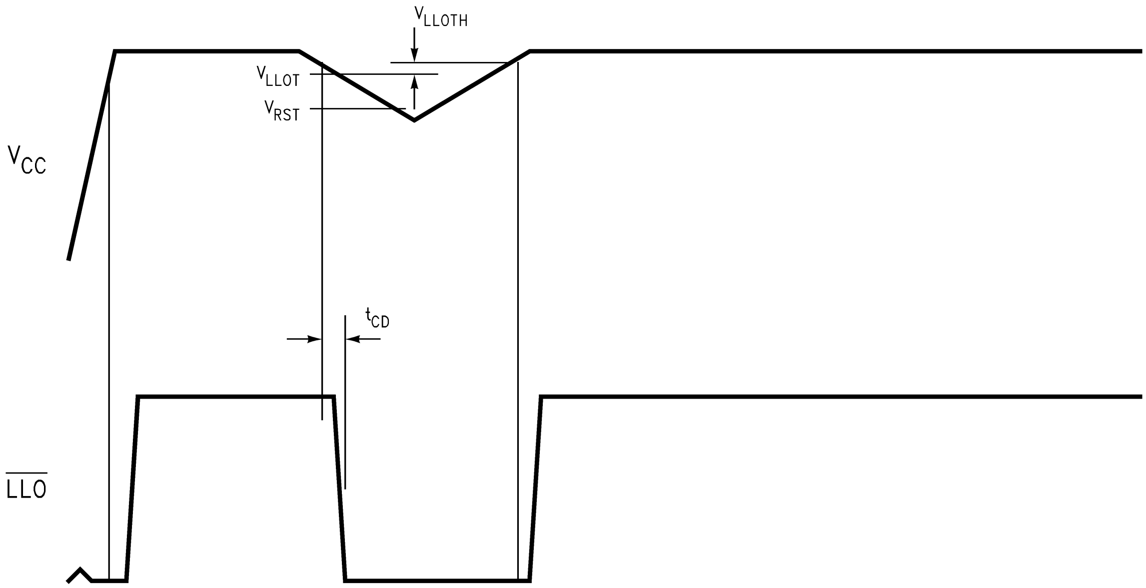


Figure 10. $\overline{\text{LLO}}$ Output

Typical Application Circuits

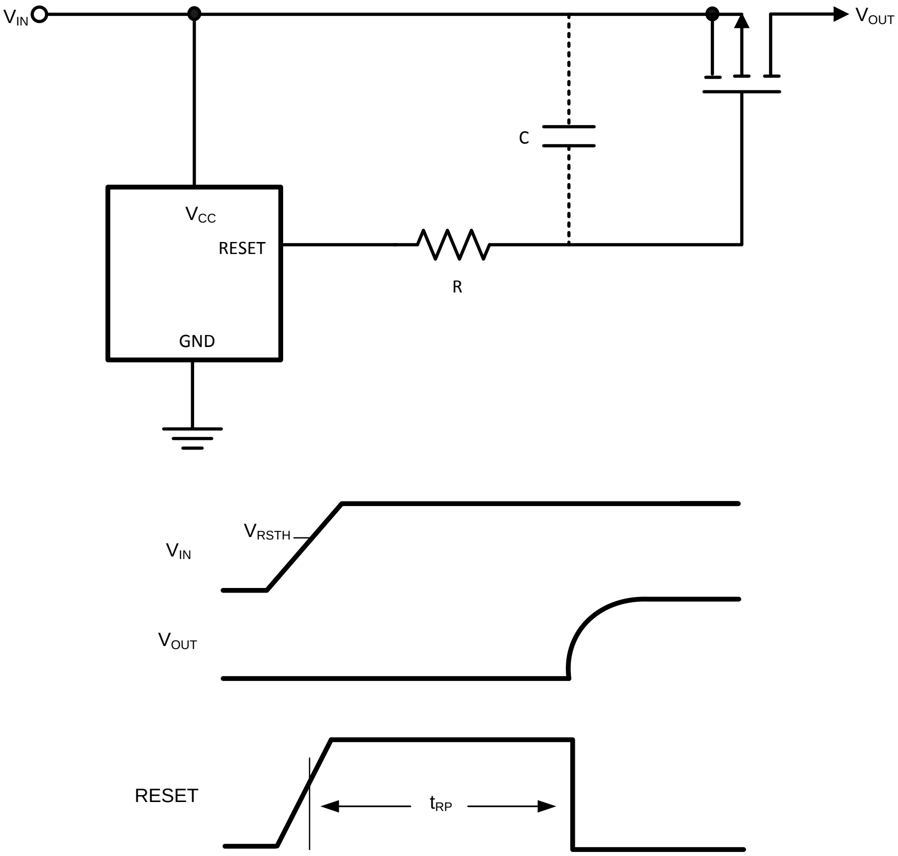


Figure 11. LM3701 Power-On Delay

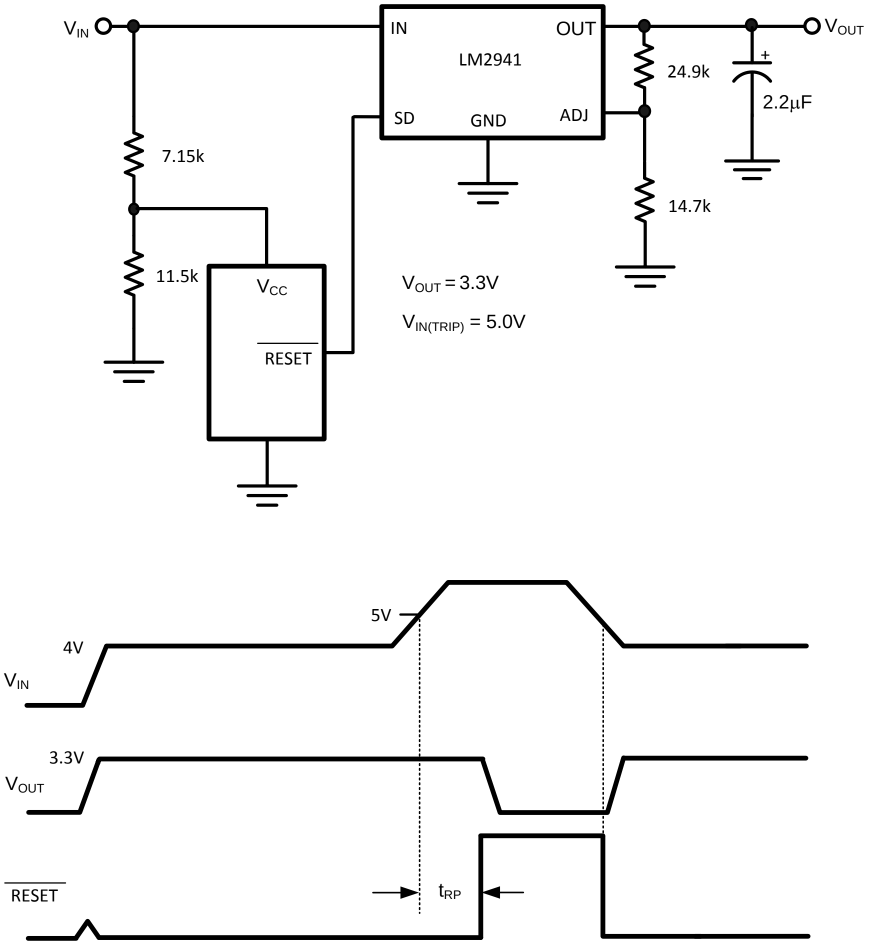


Figure 12. Regulator/Switch with Long-Term Overvoltage Lockout Prevents Overdissipation in Linear Regulator

REVISION HISTORY

Changes from Revision D (April 2013) to Revision E	Page
• Changed layout of National Data Sheet to TI format	9

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