Ultra-Low Power, Low Voltage µP Supervisory Circuit with Adjustable Delay

Description

The EM6354 monitors the supply voltage of any electronic system, and generates the appropriate reset signal. The threshold defines the minimum allowed voltage which guarantees the good functionality of the system. As long as V_{DD} stays above the threshold voltage, the output stays inactive. If V_{DD} drops below V_{TH}, the output gets active. When V_{DD} rises above V_{TH}, the output remains active for an additional delay time. This allows the system to stabilize before getting fully active.

A reset signal is asserted after a certain delay time. This delay time, or timeout reset period, can be adjusted using an external capacitor.

There are 11 standard threshold voltages between 1.31V and 4.63V for use with a wide range of power supplies.

The EM6354 features three output types: active-low push-pull, active-low open-drain and active-high push-pull. The output is guaranteed to be in the correct state for V_{DD} down to 0.8V.

The EM6354 is available in SOT23-5 and SC70-4L packages. It has an operating temperature range from -40°C to +125°C.

Features

- ±3% reset threshold (-40°C and +125°C)
- 11 standard thresholds: 4.63V, 4.4V, 3.08V, 2.93V, 2.63V, 2.2V, 1.8V, 1.66V, 1.57V, 1.38V, 1.31V
- Ultra-low supply current of 3.5µA
- Operating temperature range: -40°C to +125°C
- 3 reset output options:
    Active-low $\overline{\text{RESET}}$ push-pull
    Active-low $\overline{\text{RESET}}$ open-drain
    Active-high RESET push-pull
- Reset guaranteed for regulated output voltage down to 0.8V
- Adjustable timeout reset period using an external capacitor
- Immune to short negative V_{DD} transients
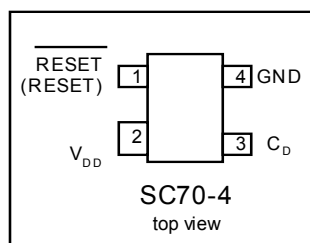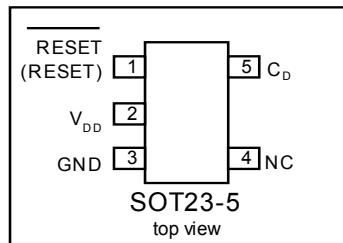- Threshold hysteresis: 2.5% of V_{TH}
- Small SC70-4L and SOT23-5L packages
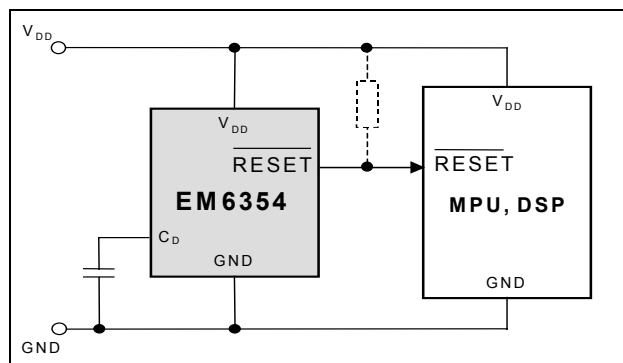
Applications

- Microprocessor & microcontroller systems
- Portable/Battery-Powered equipment
- Notebook/desktop computers
- Wireless communication
- Automotive
- Household appliances
- Industrial electronics

Typical Application

Pin Configuration

Absolute Maximum Ratings

Parameter	Symbol	Conditions
Voltage at V_{DD} to GND	V_{DD}	-0.3V to +6V
Minimun voltage at reset	V_{MIN}	GND - 0.3V
Maximun voltage at reset	V_{MAX}	V_{DD} + 0.3V
Storage Temperature Range	T_{STG}	-65°C to +150°C

Stresses above these listed maximum ratings may cause permanent damages to the device. Exposure beyond specified operating conditions may affect device reliability or cause malfunction.

Handling Procedures

This device has built-in protection against high static voltages or electric fields; however, anti-static precautions must be taken as for any other CMOS component. Unless otherwise specified, proper operation can only occur when all terminal voltages are kept within the voltage range. Unused inputs must always be tied to a defined logic voltage level.

Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply voltage	V_{DD}	0.8	5.5	V
Operating Temperature	T_A	-40	+125	°C

Electrical Characteristics

Unless otherwise specified: V_{DD}= 0.8V to 5.5V, T_A=-40°C to +125°C.

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Supply current (note 1)	I_{DD}	V_{DD}=1V			2.9		µA
		V_{DD}=2.5V			3.5		
		V_{DD}=5.0V			4.9		
Threshold voltage (note 2)	V_{TH}	EM6354 – 1.31	+25°C		1.31		V
			-40°C to +85°C	$0.98 \bullet V_{TH}$	1.31	$1.02 \bullet V_{TH}$	
			-40°C to +125°C	$0.97 \bullet V_{TH}$	1.31	$1.03 \bullet V_{TH}$	
		EM6354 – 1.38	+25°C		1.38		
			-40°C to +85°C	$0.98 \bullet V_{TH}$	1.38	$1.02 \bullet V_{TH}$	
			-40°C to +125°C	$0.97 \bullet V_{TH}$	1.38	$1.03 \bullet V_{TH}$	
		EM6354 – 1.57	+25°C		1.57		
			-40°C to +85°C	$0.98 \bullet V_{TH}$	1.57	$1.02 \bullet V_{TH}$	
			-40°C to +125°C	$0.97 \bullet V_{TH}$	1.57	$1.03 \bullet V_{TH}$	
		EM6354 – 1.66	+25°C		1.66		
			-40°C to +85°C	$0.98 \bullet V_{TH}$	1.66	$1.02 \bullet V_{TH}$	
			-40°C to +125°C	$0.97 \bullet V_{TH}$	1.66	$1.03 \bullet V_{TH}$	
		EM6354 – 1.80	+25°C		1.80		
			-40°C to +85°C	$0.98 \bullet V_{TH}$	1.80	$1.02 \bullet V_{TH}$	
			-40°C to +125°C	$0.97 \bullet V_{TH}$	1.80	$1.03 \bullet V_{TH}$	
		EM6354 – 2.20	+25°C		2.20		
			-40°C to +85°C	$0.98 \bullet V_{TH}$	2.20	$1.02 \bullet V_{TH}$	
			-40°C to +125°C	$0.97 \bullet V_{TH}$	2.20	$1.03 \bullet V_{TH}$	
		EM6354 – 2.63	+25°C		2.63		
			-40°C to +85°C	$0.98 \bullet V_{TH}$	2.63	$1.02 \bullet V_{TH}$	
			-40°C to +125°C	$0.97 \bullet V_{TH}$	2.63	$1.03 \bullet V_{TH}$	
		EM6354 – 2.93	+25°C		2.93		
			-40°C to +85°C	$0.98 \bullet V_{TH}$	2.93	$1.02 \bullet V_{TH}$	
			-40°C to +125°C	$0.97 \bullet V_{TH}$	2.93	$1.03 \bullet V_{TH}$	
		EM6354 – 3.08	+25°C		3.08		
			-40°C to +85°C	$0.98 \bullet V_{TH}$	3.08	$1.02 \bullet V_{TH}$	
			-40°C to +125°C	$0.97 \bullet V_{TH}$	3.08	$1.03 \bullet V_{TH}$	
		EM6354 – 4.40	+25°C		4.40		
			-40°C to +85°C	$0.98 \bullet V_{TH}$	4.40	$1.02 \bullet V_{TH}$	
			-40°C to +125°C	$0.97 \bullet V_{TH}$	4.40	$1.03 \bullet V_{TH}$	
		EM6354 – 4.63	+25°C		4.63		
			-40°C to +85°C	$0.98 \bullet V_{TH}$	4.63	$1.02 \bullet V_{TH}$	
			-40°C to +125°C	$0.97 \bullet V_{TH}$	4.63	$1.03 \bullet V_{TH}$	
Threshold hysteresis	V_{HYS}				$0.025 \bullet V_{TH}$		V

Note 1: $\overline{RESET}$ (RESET) open.

Note 2: Threshold voltage is specified for V_{DD} falling.

## Electrical Characteristics (continued)

Unless otherwise specified: V_{DD}= 0.8V to 5.5V, T_A=-40°C to +125°C.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reset timeout period	t_{POR}	V_{DD}=5V, C_D=100nF		100		ms
Propagation delay time V_{DD} to $\overline{RESET}$ delay	t_{PHL}	V_{DD} drops to $V_{TH\,(typ)}$-0.2V		80		µs
Open Drain $\overline{RESET}$ output Voltage	V_{OL}	V_{DD}>1V, I_{OL}=0.5mA			0.3	V
		V_{DD}>2.5V, I_{OL}=1.5mA			0.3	
		V_{DD}>5V, I_{OL}=3mA			0.3	
Push-pull RESET / $\overline{RESET}$ output voltage	V_{OL}	V_{DD}>1V, I_{OL}=0.5mA			0.3	V
		V_{DD}>2.5V, I_{OL}=1.5mA			0.3	
		V_{DD}>5V, I_{OL}=3mA			0.3	
	V_{OH}	V_{DD}>1V, I_{OH}=-0.1mA	0.8			
		V_{DD}>2.5V, I_{OH}=-1.5mA	2			
		V_{DD}>5V, I_{OH}=-3mA	4			
Output leakage current	I_{LEAK}	(note 3)			0.5	µA

Note 3: Only for open-drain version.

Timing Waveforms
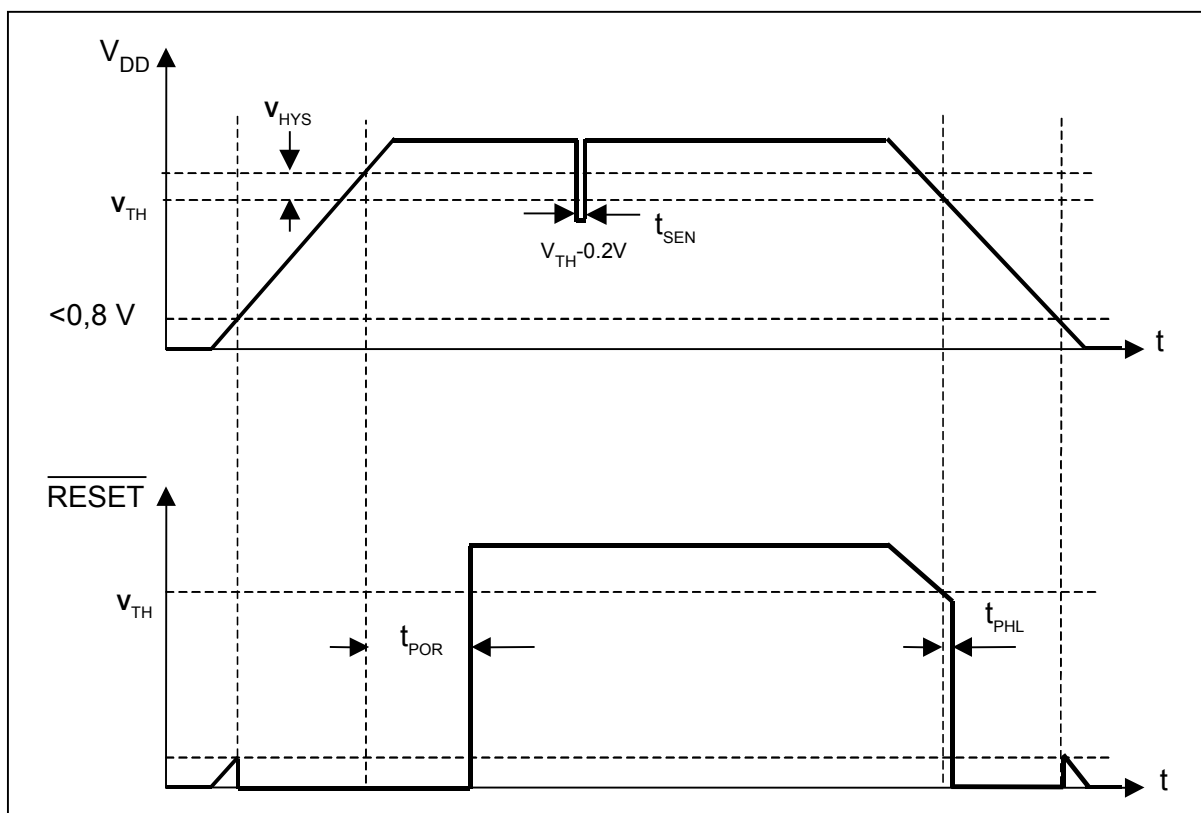
APPLICATION INFORMATION

Reset Timeout Period

The Reset Timeout Period (t_{POR}) is programmable using an external capacitor connected to pin C_D of EM6354. A ceramic chip capacitor rated at or above 10V is sufficient. The Reset Timeout Period (t_{POR}) can be calculated using the following formula:

t_{POR} (ms) = 1000 x C_D (µF).

For example a C_D of 100nF will achieve a t_{POR} of 100 ms. If no delay due to t_{POR} is needed in a certain application, the circuit EM6352 should be used instead.

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