

# CAT8710

## Quad Voltage Supervisor

The CAT8710 is a space-saving, precision quad voltage supervisor, designed to monitor up to four supply voltages with a single device. When any supply voltage drops below its preset threshold, the CAT8710 will output a single reset to the threshold. One CAT8710 IC eliminates the need for multiple reset circuits, which minimizes system components and improves reliability.

The CAT8710 provides 2 factory preset thresholds for monitoring 3.3 V, 3.0 V, 2.5 V, and 1.8 V supplies within  $\pm 5\%$  and 2 user-selectable thresholds, adjustable down to 0.62 V with 2% accuracy. On power up, the reset remains low for 120 ms typical, after all voltages have risen above their selected thresholds. The output remains valid as long as VDD remains above 1 V.

The CAT8710 is available in a 6-pin TSOT-23 package and operates over the industrial temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

### Features

- Monitors 4 Power-Supply Voltages Simultaneously
- 2 Factory Preset Reset Threshold Options for 3.3 V, 3.0 V, 2.5 V, and 1.8 V Supplies
- 2 User-Programmed Threshold Monitors, Adjustable Down to 0.62 V with 2% Accuracy
- Drop-in replacement to MAX6710
- Low Supply Current: 3  $\mu\text{A}$  (typ)
- Ultra Low Power vs. Maxim
- Reset Timeout Period: 120 ms (typ)
- $\overline{\text{RESET}}$  Valid to  $V_{\text{CC}} = 1\text{ V}$
- Immune to Short Supply Transients
- Temperature Range:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- Small, TSOT-23 6-Pin Package
- This Device is Pb-Free, Halogen Free/BFR Free and RoHS Compliant

### Applications

- Monitoring of Multiple Power Supply Voltages

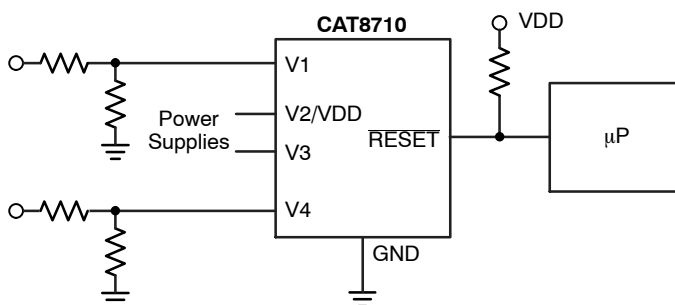


Figure 1. Typical Application Circuit



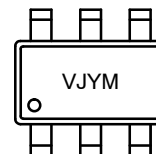
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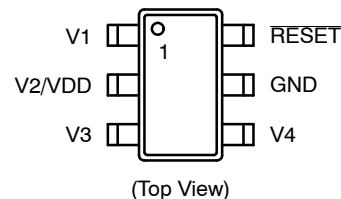
**TSOT-23-6  
TD SUFFIX  
CASE 419AF**

### MARKING DIAGRAM



VJ = Specific Device Code  
Y = Production Year (last digit)  
M = Production Month: 1-9, A, B, C

### PIN CONNECTIONS



(Top View)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

# CAT8710

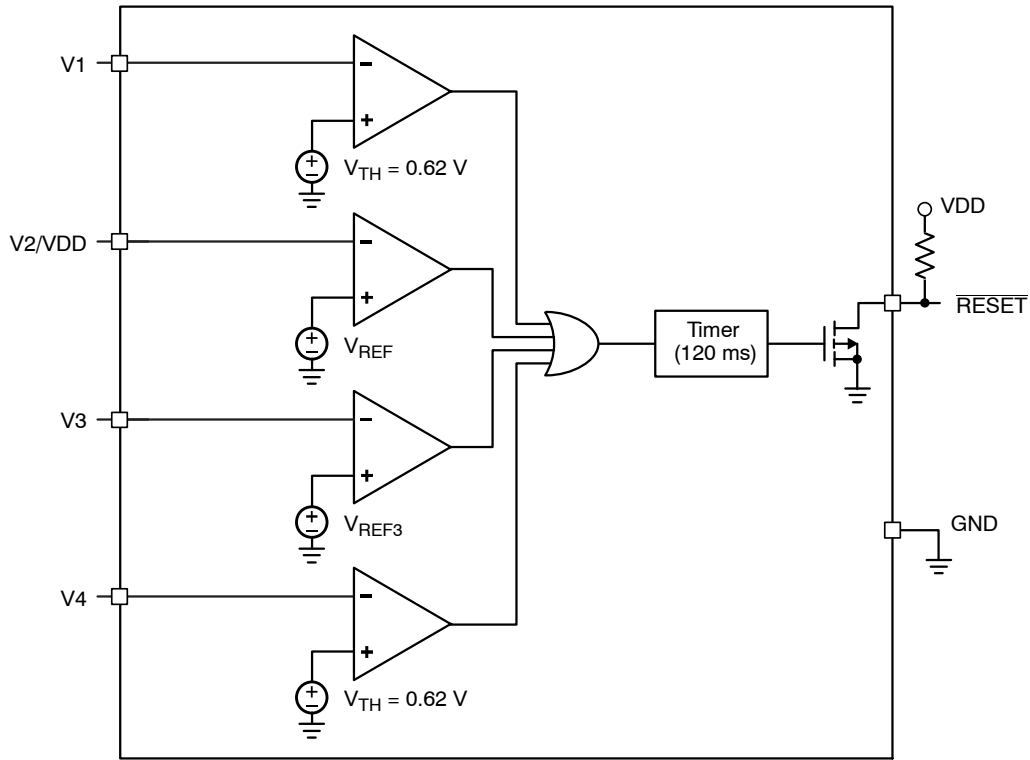


Figure 2. CAT8710 Block Diagram

Table 1. PIN FUNCTION

Pin Name	Function
V1	Adjustable under-voltage detector input.
V2/VDD	First preset under-voltage detector input and power for internal circuitry.
V3	Second preset under-voltage detector input.
V4	Adjustable under-voltage detector input.
GND	Ground
RESET	Open Drain active LOW reset output

Table 2. ORDERING INFORMATION

Part Number	Nominal Input Voltage [V]				Supply Tolerance	Package	T&R Quantity
	V1	V2/VDD	V3	V4			
CAT8710FTD-GT3	Adj (Note 2)	3.3	2.5	1.8	5%	TSOT-23-6	3,000
CAT8710JTD-GT3 (Note 1)		3.3	2.5	Adj			
CAT8710LTD-GT3 (Note 1)		3.3	1.8	Adj			
CAT8710NTD-GT3 (Note 1)		3.0	2.5	Adj			
CAT8710PTD-GT3 (Note 1)		3.0	1.8	Adj			

1. Consult factory for availability.

2. Adjustable threshold voltage when using external resistor divider. The internal voltage threshold is set to 0.62 V.

**Table 3. ABSOLUTE MAXIMUM RATINGS**

Rating	Value	Unit
$V_{DD}$ , $V_x$ , $\overline{\text{RESET}}$ to GND	-0.3 to +6.0	V
Continuous $\overline{\text{RESET}}$ Current	20	mA
Operating Temperature Range	-40 to +85	°C
Storage Temperature Range	-65 to +150	°C
Junction Temperature	+150	°C
Lead Temperature (soldering, 10 s)	+300	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

**Table 4. ELECTRICAL CHARACTERISTICS**

( $V_{DD} = 1.0\text{ V}$  to  $5.5\text{ V}$ ,  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ , unless otherwise noted. Typical values are at  $V_{DD} = 3.0\text{ V}$  to  $3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$ .) (Note 3)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
V <sub>DD</sub>	Operating Voltage			1.5		5.5	V
I <sub>DD</sub>	Supply Current on V2/VDD	V <sub>DD</sub> = 5 V			1.2	9	μA
I <sub>DD3</sub>	Leakage Current on V3	V <sub>DD3</sub> = 3.3 V			0.1	1	μA
I <sub>ADJ</sub>	Leakage Current, V1, V4	V <sub>ADJ</sub> = 1.0 V			15	50	nA
V <sub>REF</sub> V <sub>REF3</sub>	Threshold Voltage on V2/VDD and V3	Monitored voltage decreasing	V <sub>DD</sub> = 3.3 V option	3.00	3.08	3.15	V
			V <sub>DD</sub> = 3.0 V option	2.70	2.78	2.85	V
			V <sub>DD</sub> = 2.5 V option	2.25	2.32	2.38	V
			V <sub>DD</sub> = 1.8 V option	1.62	1.67	1.71	V
V <sub>TH</sub>	Adjustable Threshold Voltage on V1 and V4	Monitored voltage decreasing		0.611	0.620	0.629	V
V <sub>HYST</sub>	Reset Threshold Hysteresis	Monitored voltage increasing compared to monitored voltage decreasing			0.3		%V <sub>TH</sub>
TCV <sub>TH</sub>	Reset Threshold Temperature Coefficient				60		ppm/°C
t <sub>RD</sub>	V <sub>IN</sub> to Reset Delay	V <sub>IN</sub> falling at 10 mV/μs from V <sub>TH</sub> to (V <sub>TH</sub> – 50 mV)		1	6		μs
t <sub>RP</sub>	Reset Timeout Period	CAT8710		70	120	240	ms
V <sub>OL</sub>	RESET Output Low	V <sub>CC</sub> ≥ 5 V, I <sub>SINK</sub> = 2.5 mA			0.05	0.4	V
		V <sub>CC</sub> < 3.3 V, I <sub>SINK</sub> = 1.5 mA			0.05	0.4	

3. 100% production tested at  $T_A = +25^\circ\text{C}$ . Limits over temperature guaranteed by design.

4. The devices are powered from  $V_{DD}$ .

5. The  $\overline{\text{RESET}}$  output is guaranteed to be in the correct state for  $V_{DD}$  down to  $1\text{ V}$ .

# TYPICAL CHARACTERISTICS

( $V_{DD} = V_{CC} = 3.0\text{ V}$ ,  $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

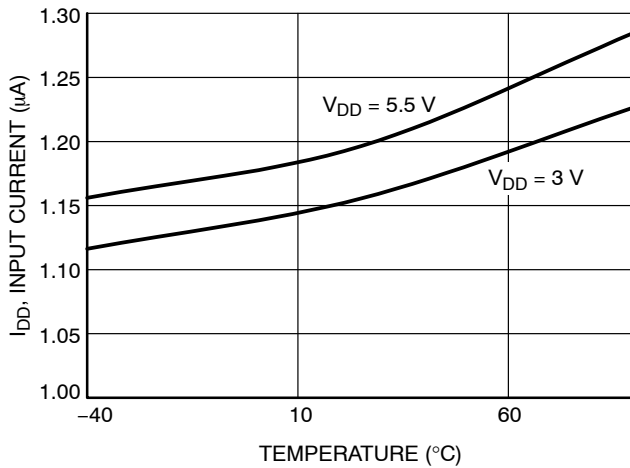


Figure 3.  $I_{DD}$  Input Current vs. Temperature

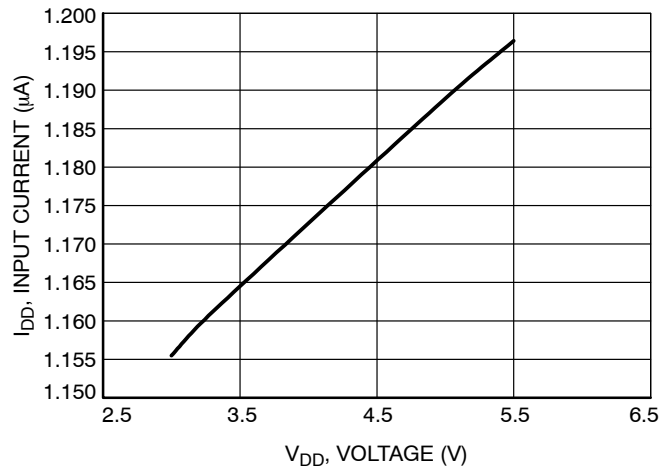


Figure 4.  $I_{DD}$  Input Current vs.  $V_{DD}$  Voltage

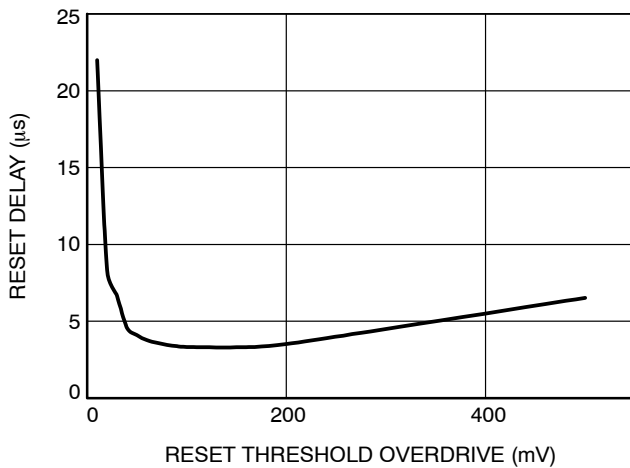


Figure 5.  $\overline{\text{RESET}}$  Delay vs. RESET Threshold Overdrive (As Monitored Voltage is Decreasing)

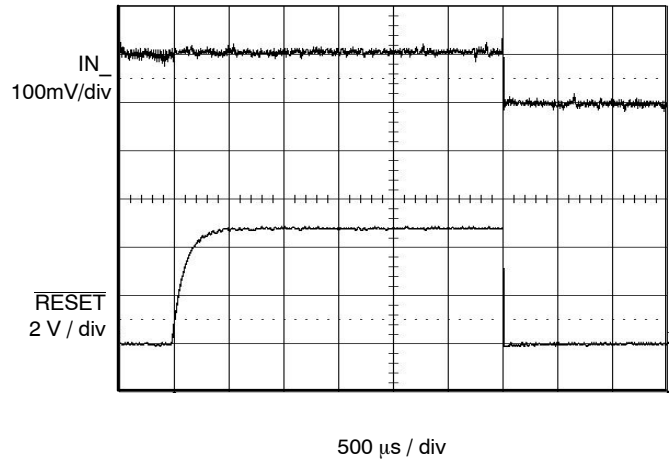


Figure 6.  $\overline{\text{RESET}}$  Pull-up and Pulldown Response ( $C_L = 47\text{ pF}$ ,  $R_L = 470\text{ k}\Omega$ )

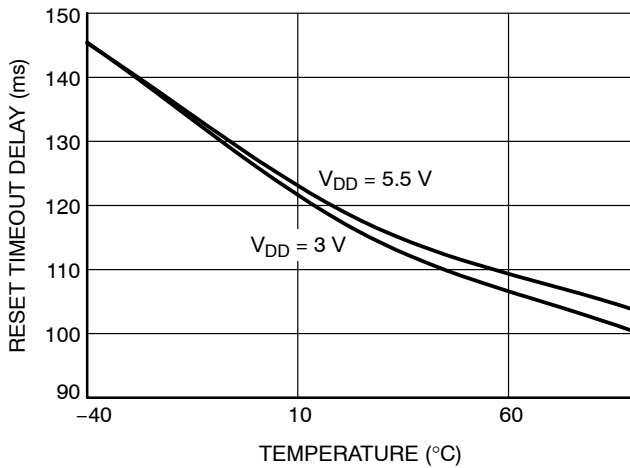


Figure 7.  $\overline{\text{RESET}}$  Timeout Delay vs. Temperature

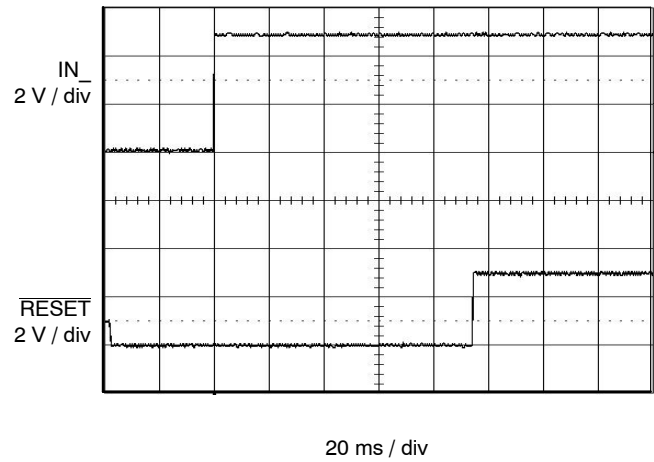


Figure 8.  $\overline{\text{RESET}}$  Timeout Delay

## Detailed Description

The CAT8710 is a space-saving, low-power, quad voltage microprocessor supervisory circuit designed to monitor 4 voltage supplies. The CAT8710 has 2 factory preset thresholds for monitoring standard power supply voltages of 3.3 V, 3.0 V, 2.5 V, or 1.8 V, and 2 adjustable thresholds for monitoring voltages as low as 0.62 V.

Each internal voltage comparator has a typical hysteresis of 0.3% with respect to its reset threshold, which improves immunity to ambient noise without significantly reducing threshold accuracy. CAT8710 is designed to ignore short transients.

## Applications Information

### Reset Output

CAT8710 provides an extended reset signal 120 ms (typ) in duration. The output is open drain and requires an external pull-up resistor to an external power supply. This supply can be less than or greater than VDD, but should not exceed 5.5 V. When the external pull-up voltage is greater than VDD reverse current flow from the external pull-up voltage to VDD is prevented by CAT8710's internal circuitry.

The CAT8710 is powered by VDD, which is also a monitored voltage. When any supply drops below its threshold, the reset output asserts low and remains low as long as VDD is above 1.0 V.

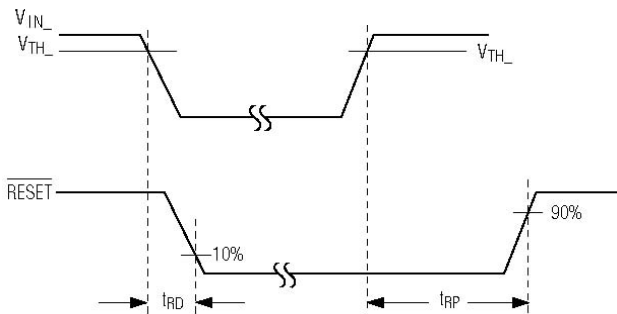


Figure 9. RESET Output Timing Diagram

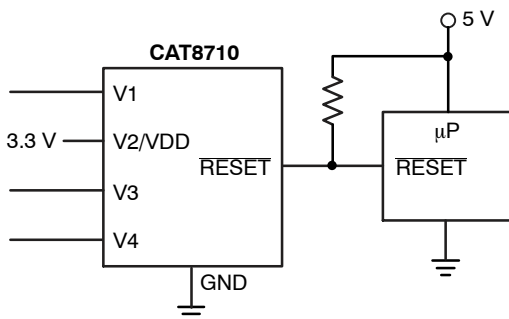


Figure 10. Interfacing to Different Logic-Supply Voltage

## Adjustable Thresholds

CAT8710 allows users to create 2 custom voltage thresholds. The threshold voltage at each adjustable input is typically 0.62 V. Monitoring of voltages greater than 0.62 V requires a resistor-divider network to be connected to the circuit (Figure 11).

$$V_{IN} = 0.62 \text{ V} \times \frac{(R1 + R2)}{R2}$$

or, written in terms of R1:

$$R1 = R2 \left( \frac{V_{IN}}{0.62 \text{ V}} - 1 \right)$$

Because the CAT8710 has a guaranteed input current of less than 50 nA on the adjustable inputs, resistor values up to 1000 kΩ can be used for R2 with < 1% error.

## Unused Inputs

Connect unused monitor inputs to a supply voltage greater in magnitude than their specified threshold voltages; use VDD for normal operation (device power-supply pin). Do not connect unused monitor inputs to ground or allow them to float.

## Adding Manual Reset Capability

Figure 12 illustrates how to add manual reset to the CAT8710. Depressing the pushbutton switch short-circuits the analog input to ground and initiates a RESET pulse. This technique can be used on either the V1 or V4 inputs. The switch must be open for at least 120 ms in order to deassert the RESET output. No external switch debounce is required. A small capacitor across R2 will improve noise immunity when using long leads from the pushbutton switch to the adjustable input.

## POR

Applying power to the CAT8710 activates a POR circuit which activates the reset output (active low). At power-up POR prevents the system microprocessor from starting to operate with insufficient voltage and prior to stabilization of the clock oscillator. It ensures that operation is precluded until internal registers are properly loaded, FPGA's have downloaded their configuration data. The reset signal remains active until all monitored power supplies have risen above their minimum preset voltage levels.

## Power-Supply Bypassing

All monitored inputs are immune to short supply transients. For applications where higher immunity is required, connect a 0.1 μF bypass capacitor from each input pin to ground very close to CAT8710's package.

CAT8710

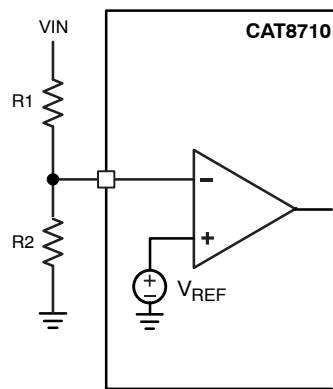


Figure 11. Setting the Auxiliary Monitor

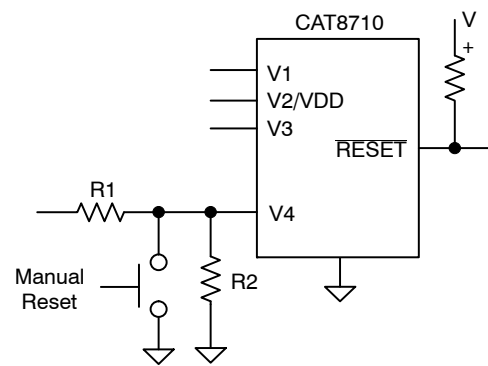
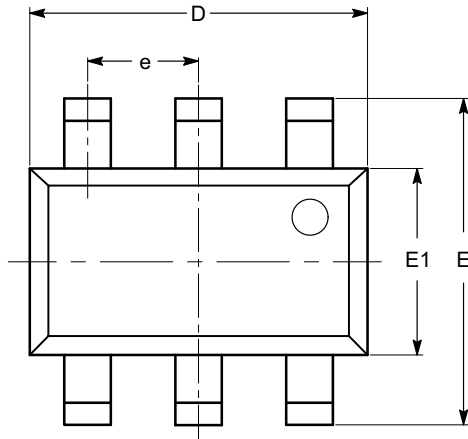


Figure 12. Adding Manual Reset Capability

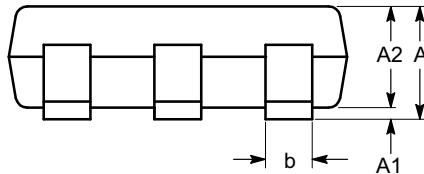
# CAT8710

## PACKAGE DIMENSIONS

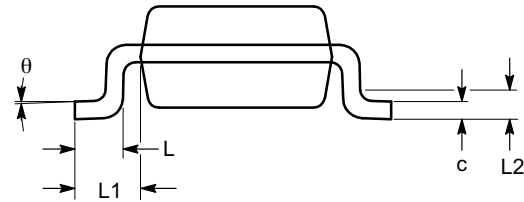
TSOT-23, 6 LEAD  
CASE 419AF-01  
ISSUE O



TOP VIEW



SIDE VIEW




END VIEW

SYMBOL	MIN	NOM	MAX
A			1.00
A1	0.01	0.05	0.10
A2	0.80	0.87	0.90
b	0.30		0.45
c	0.12	0.15	0.20
D	2.90 BSC		
E	2.80 BSC		
E1	1.60 BSC		
e	0.95 TYP		
L	0.30	0.40	0.50
L1	0.60 REF		
L2	0.25 BSC		
θ	0°		8°

### Notes:

- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MO-193.

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