SQ52111

36V High-speed Zero-drift Voltage Output Current Shunt Monitor with High-speed over Current Comparator

Advanced Design Specification

General Description

SQ52111 include both a high common mode, current sensing amplifier and a high-speed comparator configured to detect overcurrent conditions through measuring the voltage developed across a current-sensing resistor and comparing that voltage with a defined threshold limit. The device features an adjustable limit threshold range that is set using a single external resistor. This current shunt monitor can measure differential voltage signals on common-mode voltages that can vary from 0V up to 36V, independent of the supply voltage.

The open drain alert output can be configured to operate in either a transparent mode where the output status follows the input state or in a latched mode where the alert output is cleared when the latch is reset. The device alert response time is under 1.25µs, allowing for quick detection of overcurrent events.

SQ52111 operates from a single 2.7V to 5.5V supply, drawing a maximum supply current of 700µA. The device is specified over the extended operating temperature range (–40℃ to +125℃), and is available in an 8-pin MSOP package.

Features

- Wide Common Mode Range: 0V to 36V
- Dual Output: Amplifier and Comparator Output
- High Accuracy Amplifier:
  - Offset Voltage: 135µV (Max)
  - Offset Voltage Drift: 0.5µV/°C (Max)
  - Gain Error: 0.1% (Max)
  - Gain Error Drift: 10ppm/ ℃ (Max)
- Available Amplifier Gain: 20V/V
- Programmable Alert Threshold Setting Through a Single Resistor
- Total Alert Response Time: 1.25µs
- Open Drain Output with Latching Mode
- Package: MSOP8

Applications

- Overcurrent Protection
- Power-Supply Protection
- Circuit Breakers
- Computers and Servers
- Telecom Equipment
- Battery Management

Ordering Information

SQ52111 □(□□□)

Package Code

Optional Spec Code

Ordering Number	Package type	Note
SQ52111CAP	MSOP8	

Typical Application

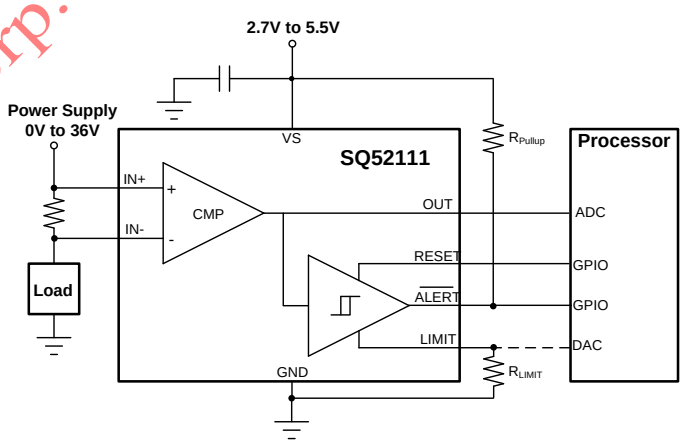
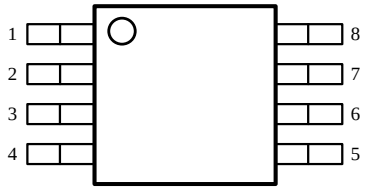


Figure 1. Typical Application

Pin out (Top View)



(MSOP8)

Top mark: **DYT*xyz*** (Device code: **DYT**, ***x=year code, y=week code, z= lot number code***)

Pin Number	Pin Name	Function Description
1	VS	Power supply, 2.7V to 5.5V.
2	OUT	Output voltage.
3	LIMIT	Alert threshold limit input.
4	GND	Ground.
5	RESET	Transparent or latch mode selection input.
6	ALERT	Overlimit alert, active low, open drain output.
7	IN-	Connect to load side of shunt resistor.
8	IN+	Connect to supply side of shunt resistor.

Absolute Maximum Ratings

V_S ---------- -0.3V~6V
Differential V_{IN+} - V_{IN-} ---------- -40V~40V
Common mode, V_{IN+}, V_{IN-} ---------- -0.3V~40V
Alert output V_{ALERT} ---------- -0.3V~6V
Input voltage at Any Pin ---------- -0.3V~V_S+0.3V

Maximum Junction Temperature ---------- 150 ℃
Storage Temperature Range ---------- -65 ℃~150 ℃

Recommended Operating Conditions

V_S ---------- 5V
Common mode, V_{IN+}, V_{IN-} ---------- 12V
Operation Temperature ---------- -40~125 ℃

Electrical Characteristics

At T_A=25 ℃, V_{IN}=V_{IN+}–V_{IN-}=10mV, V_S=5V, V_{IN+}=12V and V_{LIMIT}=2V, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Input						
Common Mode Input Voltage	V_{CM}		0		36	V
Differential Input Voltage	V_{IN}	V_{IN}=V_{IN+}-V_{IN-}	0		250	mV
Common Mode Rejection	CMR	V_{IN}=0V~36V, T_A=-40 ℃~+125 ℃	100	110		dB
Offset Voltage, RTI	V_{OS}			±35	±135	μV
Offset Voltage Drift, RTI	dV_{OS}/dT	T_A=-40 ℃~+125 ℃		0.1	0.5	μV/ ℃
Power Supply Rejection Ratio	PSR	V_S=2.7V~5.5V, V_{IN+}=12V, T_A=-40 ℃~+125 ℃		±0.1	±10	μV/V
Input Bias Current (Note 2)	I_B			120		μA
Input Offset Current (Note 3)	I_{OS}			±0.2		μA
Output						
Gain	G			20		V/V
Gain Error		V_{OUT}=0.5V~V_S-0.5V		±0.03	±0.1	%
		T_A=-40 ℃~+125 ℃		3	10	ppm/ ℃
Nonlinearity Error		V_{OUT}=0.5V~V_S-0.5V		±0.01		%
Maximum Capacitive Load		No sustained oscillation		500		pF
Voltage Output						
Swing to V_S Power Supply Rail		R_L=10kΩ to GND, T_A=-40 ℃~+125 ℃		V_S-0.05	V_S-0.1	V
Swing to GND		R_L=10kΩ to GND, T_A=-40 ℃~+125 ℃		V_{GND}+20	V_{GND}+30	mV
Frequency Response						
Band Width	BW			550		kHz
Slew Rate	SR			4		V/μs
Noise, RTI						
Voltage Noise Density				30		nV/ √ Hz
Comparator						
Total Alert Propagation Delay	t_p	Input overdrive=1mV (Note 4) V_{IN} to Alert Propagation		1.25		μs
Slew-rate-limited t_p		V_{OUT} step=0.5V ~ 4.5V, V_{LIMIT}=4V		1	1.5	
Limit Threshold Output Current	I_{LIMIT}		79.7	80	80.3	μA
		T_A=-40 ℃~+125 ℃	79.2		80.8	
Comparator Offset Voltage	V_{OS}			1		mV
Hysteresis	HYS			20		mV
High Level Input Voltage	V_{IH}		2.5		6	V
Low Level Input Voltage	V_{IL}		0		0.4	V
Alert Low Level Output Voltage	V_{OL}	I_{OL}=3mA		70	300	mV
ALERT Terminal Leakage Input Current		V_{OH}=3.3V		0.1	1	μA
Digital Leakage Input Current		0<V_{IN}<V_S		1		μA

Power Supply						
Operating Supply Range	V_S	T_A=-40℃~+125℃	2.7		5.5	V
Quiescent Current	I_Q	V_{IN}=0mV, T_A=25℃		300		μA
		V_{IN}=125mV, T_A=25℃		500	650	
		T_A=-40℃~+125℃			700	

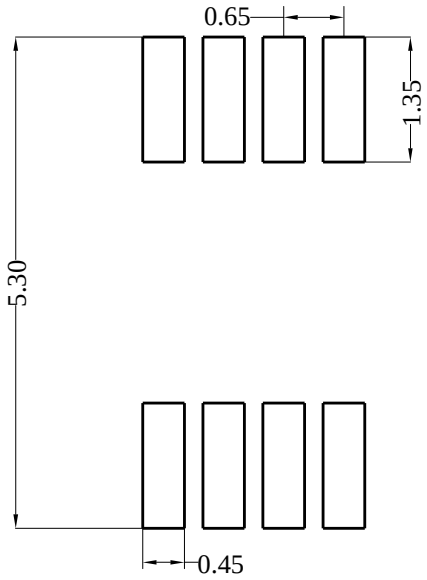
Note 1: Stresses beyond the "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note 2: Input bias current is decided by the sum of the input currents of the pin IN+ and IN-.

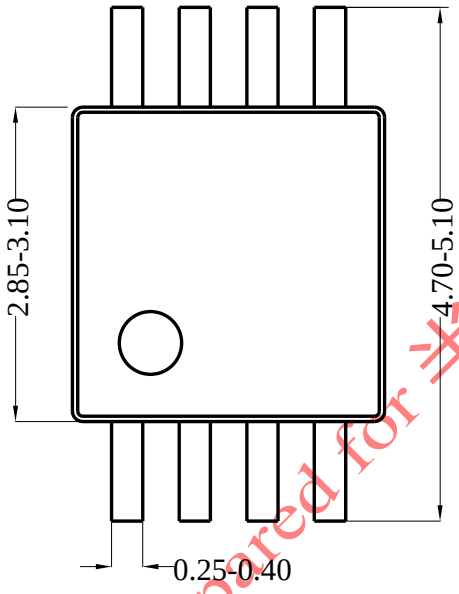
Note 3: Input offset current is decided by the error between the input currents of the pin IN+ and IN-.

Note 4: Overdrive = (V_{OUT} – V_{LIMIT}) / Gain.

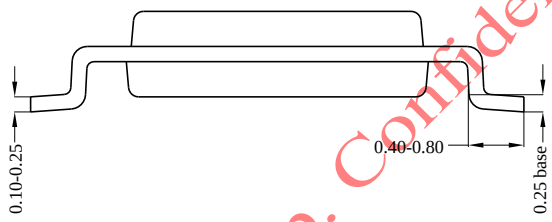
MSOP8 Package outline & PCB layout



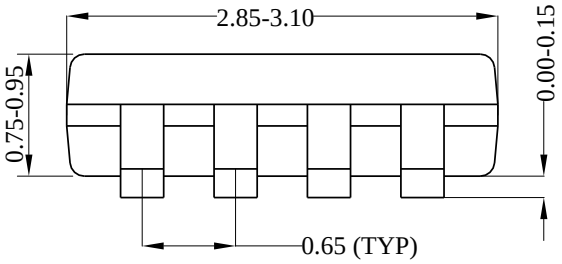
Recommended Pad Layout



Top View



Side View A



Side View B

Notes: **All dimension in millimeter and exclude mold flash & metal burr.**