1. 特性

- 完整的电流检测解决方案
- 提供三种增益选项：
  - CSA314L (20V/V)
  - CSA314M (50V/V)
  - CSA314P (100V/V)
- 0.6V 内部参考电压
- 内部集成开漏输出的比较器
- 比较器具备锁存能力
- 共模范围：–6V 至 80V
- 高精度：全温最大误差为 0.15%
- 带宽：420kHz
- 静态电流：2mA (最大值)
- 封装：MSOP-8

2. 应用

- 笔记本电脑
- 手机
- 电信设备
- 汽车
- 能源管理
- 电池充电器
- 焊接设备

3. 说明

CSA314 器件是具有电压输出和集成比较器的高边电流分流监控器。CSA314 器件可以在–6V 至 80V 的共模电压下感测分流器上的压降。CSA314 系列提供三种输出电压范围：20V/V、50V/V 和 100V/V，带宽高达 420kHz。

CSA314 器件包含一个开漏输出的比较器和提供 0.6V 阈值的内部基准。外部分压器设置电流跳变点。比较器具有锁存功能，可通过将$\overline{\text{RESET}}$引脚接地(或保持开路)来使其失能。

CSA314 器件采用 2.7V 至 5.5V 单电源供电，最大消耗 2mA 的电源电流。封装为非常小的 MSOP-8。所有版本的额定温度范围为–40°C 至+125°C。

有关订购信息，请参见 Table 1。

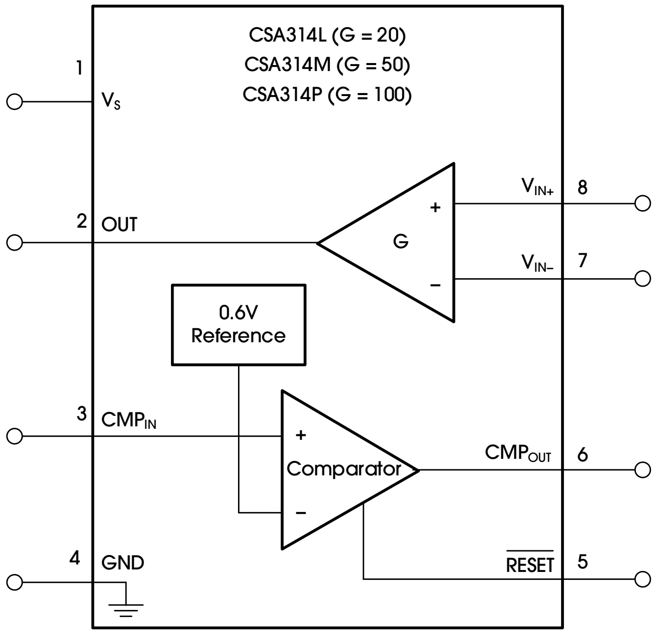


Table 1 lists the order information.

Table 1. Order Information

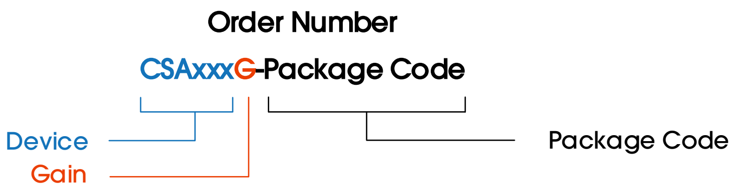
ORDER NUMBER(1)	MARK	CH (#)	PACKAGE	V_{CM} (V)	I_Q PER CH (TYP) (mA)	GBW (kHz)	GAIN (TYP) (V/V)	OPERATING TEMP (°C)	RATING	PACKAGE OPTION	MSL
CSA314LAMSOP8	CSA314L XXXXXX	1	MSOP-8	–6-80	Normal	420	20	-40-125	Industrial	T/R-4000	MSL2
CSA314MAMSOP8	CSA314M XXXXXX	1	MSOP-8	–6-80	Normal	420	50	-40-125	Industrial	T/R-4000	MSL2
CSA314PAMSOP8	CSA314P XXXXXX	1	MSOP-8	–6-80	Normal	420	100	-40-125	Industrial	T/R-4000	MSL2

Table 2. Family Selection Guide

ORDER NUMBER(1)	MARK	CH (#)	PACKAGE	V_{CM} (V)	I_Q PER CH (TYP) (mA)	GBW (kHz)	GAIN (TYP) (V/V)	OPERATING TEMP (°C)	RATING	PACKAGE OPTION	MSL
CSA315LATSSOP14	CSA315L XXXXXX	1	TSSOP-14	–6-80	1.7	420	20	-40-125	Industrial	T/R-4000	MSL2
CSA315MATSSOP14	CSA315M XXXXXX	1	TSSOP-14	–6-80	1.7	420	50	-40-125	Industrial	T/R-4000	MSL2
CSA315PATSSOP14	CSA315P XXXXXX	1	TSSOP-14	–6-80	1.7	420	100	-40-125	Industrial	T/R-4000	MSL2
CSA311LAMSOP8	CSA311L XXXXXX	1	MSOP-8	–6-80	Normal	420	20	-40-125	Industrial	T/R-4000	MSL2
CSA311MAMSOP8	CSA311M XXXXXX	1	MSOP-8	–6-80	Normal	420	50	-40-125	Industrial	T/R-4000	MSL2
CSA311PAMSOP8	CSA311P XXXXXX	1	MSOP-8	–6-80	Normal	420	100	-40-125	Industrial	T/R-4000	MSL2

Devices can be ordered via the following two ways:
1. Place orders directly on our website (www.analogysemi.com), or;
2. Contact our sales team by mailing to sales@analogysemi.com.

Note 1:



Note 2: “XXXXX”: For internal use.

4. PIN CONFIGURATION AND FUNCTIONS

Figure 1 illustrates the pin configuration.

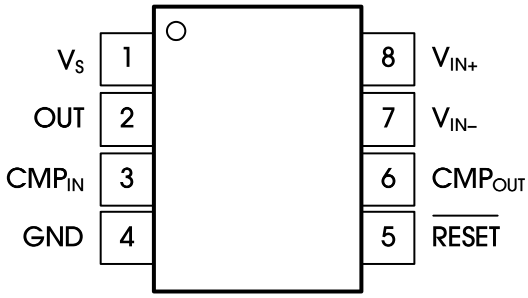


Figure 1. Pin Configuration

Table 3 lists the pin functions.

Table 3. Pin Functions

POSITION	NAME	TYPE	DESCRIPTION
1	V_S	Analog	Power supply
2	OUT	Analog output	Output voltage
3	CMP_{IN}	Analog input	Comparator input
4	GND	Analog	Ground
5	$\overline{RESET}$	Analog input	Comparator reset pin, active low
6	CMP_{OUT}	Analog input	Comparator output, open drain; connect to pull-up resistor, e.g., 4.7kΩ.
7	V_{IN-}	Analog input	Connect to shunt low side
8	V_{IN+}	Analog	Connect to shunt high side

5. SPECIFICATIONS

5.1 ABSOLUTE MAXIMUM RATINGS

Table 4 lists the absolute maximum ratings of the CSA314.

Table 4. Absolute maximum Ratings

PARAMETER	DESCRIPTION	MIN	MAX	UNITS
Voltage	Supply voltage, V_S	2.7	5.5	V
	Current-shunt monitor analog inputs, V_{IN+}, V_{IN-}, differential (V_{IN+}) – (V_{IN-})	–80	80	V
	Current-shunt monitor analog inputs, V_{IN+}, V_{IN-}, common-mode(2)	–6	80	V
	Comparator analog input and reset pins(2)	GND – 0.3	V_S + 0.3	V
	Analog output, OUT(2)	GND – 0.3	V_S + 0.3	V
	Comparator output, OUT(2)	GND – 0.3	5.5	V
	Input current into any pin(2)		5	mA
Temperature	Operating, T_A	–40	125	°C
	Junction, T_J	–40	150	°C
	Storage, T_{stg}	–65	150	°C

Note 1: Stresses beyond those listed under Table 4 may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Table 6. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
Note 2: This voltage may exceed the ratings shown if the current at that pin is limited to 5mA.

5.2 ESD RATINGS

Table 5 lists the ESD ratings of the CSA314.

Table 5. ESD Ratings

PARAMETER	SYMBOL	DESCRIPTION	VALUE	UNITS
Electrostatic Discharge	$V_{(ESD)}$	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	±6000	V
		Charged-device model (CDM), per JEDEC specification JS-002(2)	±2000	

Note 1: The JEDEC document JEP155 indicates that 500V HBM allows safe manufacturing with a standard ESD control process.
Note 2: The JEDEC document JEP157 indicates that 250V CDM allows safe manufacturing with a standard ESD control process.

 Public

5.3 RECOMMENDED OPERATING CONDITIONS

Table 6 lists the recommended operating conditions for the CSA314.

Table 6. Recommended Operating Conditions

PARAMETER	SYMBOL	MIN	NOM	MAX	UNITS
Common-Mode Input Voltage	V_{CM}	–6	12	80	V
Operating Supply Voltage	V_S	2.7	5	5.5	V
Operating Free-Air Temperature	T_A	–40	25	125	°C

5.4 THERMAL INFORMATION

Table 7 lists the thermal information for the CSA314.

Table 7. Thermal Information

PARAMETER	SYMBOL	MSOP-8	UNITS
Junction-to-Ambient Thermal Resistance	$R_{\theta JA}$	145	°C/W
Junction-to-Board Thermal Resistance	$R_{\theta JB}$	83.3	°C/W
Junction-to-Top Characterization Parameter	ψ_{JT}	1.7	°C/W
Junction-to-Board Characterization Parameter	ψ_{JB}	81.7	°C/W
Junction-to-Case (Top) Thermal Resistance	$R_{\theta JC(top)}$	48.3	°C/W

5.5 ELECTRICAL CHARACTERISTICS

5.5.1 CURRENT-SHUNT MONITOR

Table 8 lists the electrical characteristics of CSA314 (current-shunt monitor). At T_A = 25°C, V_S = 5V, V_{CM} = 12V, V_{SENSE} = 100mV, R_L = 10kΩ to GND, $R_{PULL-UP}$ = 5.1kΩ connected from CMP_{OUT} to V_S, and CMP_{IN} = GND, unless otherwise noted.

Table 8. Electrical Characteristics (Current-Shunt Monitor)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
INPUT						
Full-Scale Sense Input Voltage	V_{SENSE}	$V_{SENSE} = V_{IN+} - V_{IN-}$		0.15	(V_S – 0.25) / Gain	V
Common-Mode Input Range	V_{CM}	T_A = –40°C to 125°C	–6		80	V
Common-Mode Rejection	CMR	V_{CM} = –6V to 80V, T_A = –40°C to 125°C	132	160		dB
Offset Voltage, RTI(1)	V_{OS}	T_A = 25°C		±2	±25	μV
		T_A = –40°C to 125°C			±90	μV
Offset Voltage, RTI(1) vs. Power Supply	PSR	V_{OUT} = 2V, V_{ss} = 5V, 2.7V, T_A = –40°C to 125°C		0.2	6.31	μV/V
Input Bias Current, V_{IN-} Pin	I_B	T_A = –40°C to 125°C		±10	±200	nA
OUTPUT (V_{SENSE} ≥ 20mV)						
Gain	G	CSA314L		20		V/V
		CSA314M		50		V/V
		CSA314P		100		V/V
Gain Error		V_{SENSE} = 20mV to 100mV		0.0165	±0.15	%
Gain Error Drift		V_{SENSE} = 20mV to 100mV, T_A = –40°C to 125°C		11	30	PPM/C
Nonlinearity Error(2)		V_{SENSE} = 20mV to 100mV		±0.0035		%
Output Impedance	R_O			1.2		Ω
Maximum Capacitive Load		No sustained oscillation		1		nF
VOLTAGE OUTPUT						
Output Swing to the Positive Rail		V_{IN-} = 11V, V_{IN+} = 12V, T_A = –40°C to 125°C	(V_S) – 0.015	(V_S) – 0.005		V
Output Swing to GND(3)		V_{IN-} = 0V, V_{IN+} = –0.5V, T_A = –40°C to 125°C		GND + 1	GND + 15	mV
FREQUENCY RESPONSE						
Bandwidth	BW	CSA314L, C_{LOAD} = 5pF		420		kHz
		CSA314M, C_{LOAD} = 5pF		420		kHz
		CSA314P, C_{LOAD} = 5pF		420		kHz
Phase Margin		C_{LOAD} < 10nF		40		°
Slew Rate	SR			2		V/μs
Settling Time (1%)		V_{SENSE} = 10mV_{PP} to 100mV_{PP}, C_{LOAD} = 5pF		4		μs
NOISE, RTI						
Voltage Noise Density				90		nV/√Hz

Note 1: Offset is extrapolated from measurements of the output at 20mV and 100mV V_{SENSE}.
Note 2: Linearity is best fit to a straight line.
Note 3: Specified by design.

 Public

5.5.2 COMPARATOR

Table 9 lists the electrical characteristics of CSA314 (comparator). At T_A = 25°C, V_S = 5V, V_{CM} = 12V, V_{SENSE} = 100mV, , R_L = 10kΩ to GND, and $R_{PULL\text{-}UP}$ = 5.1kΩ connected from CMP_{OUT} to V_S, unless otherwise noted.

Table 9. Electrical Characteristics (Comparator)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
OFFSET VOLTAGE						
Threshold		T_A = 25°C	598	608	616	mV
		T_A = –40°C to 125°C	581		623	mV
Hysteresis(1)		T_A = –40°C to 85°C		–21		mV
INPUT BIAS CURRENT(2)						
Input Bias Current, CMP_{IN} Pin				0.5	10	nA
Input Bias Current, CMP_{IN} Pin, vs. Temperature		T_A = –40°C to 125°C			15	nA
INPUT VOLTAGE RANGE						
Input Voltage Range, CMP_{IN} Pin			GND		V_S	V
OUTPUT (OPEN-DRAIN)						
High-Level Leakage Current(3)(4)	I_{LKG}	V_{ID} = 0.4V, V_{OH} = V_S		0.002	0.2	μA
Low-Level Output Voltage(3)	V_{OL}	V_{ID} = –0.6V, I_{OL} = 2.35mA		25	30	mV
RESPONSE TIME						
Response Time(5)		R_L to 5V, C_L = 15pF, 100mV input step with 5mV overdrive		1		μs
$\overline{\text{RESET}}$						
$\overline{\text{RESET}}$ Threshold(6)				1		V
Logic Input Impedance				> 1		GΩ
Minimum $\overline{\text{RESET}}$ Pulse Width				< 2		μs
$\overline{\text{RESET}}$ Propagation Delay				0.03		μs

Note 1: Hysteresis refers to the threshold (the threshold specification applies to a rising edge of a noninverting input) of a falling edge on the noninverting input of the comparator; refer to Figure 2.
Note 2: Specified by design.
Note 3: V_{ID} refers to the differential voltage at the comparator inputs.
Note 4: Open-drain output can be pulled to the range of 2.7V to 18V, regardless of V_S.
Note 5: The comparator response time specified is the interval between the input step function and the instant when the output crosses 1.4V.
Note 6: The $\overline{\text{RESET}}$ input has an internal 2MΩ (typical) pull-down. Leaving $\overline{\text{RESET}}$ open results in a LOW state, with transparent comparator operation.

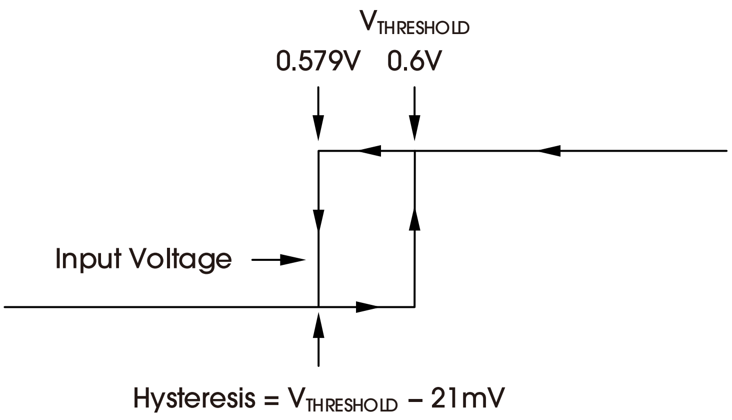


Figure 2. Typical Comparator Hysteresis

5.5.3 REFERENCE

Table 10 lists the electrical characteristics of CSA314 (reference). At T_A = 25°C, V_S = 5V, V_{CM} = 12V, V_{SENSE} = 100mV, R_L = 10kΩ to GND, R_{PULLUP} = 5.1kΩ connected from CMP_{OUT} to V_S, unless otherwise noted.

Table 10. Electrical Characteristics (Reference)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
REFERENCE VOLTAGE						
0.6 V_{REF} Output Voltage				607		mV
Reference Drift	dV_{OUT}/dT	T_A = −40°C to 125°C		20	120	ppm/°C
LOAD REGULATION						
Line Regulation	dV_{OUT}/dV_S	2.7V < V_S < 5.5V		±100		μV/V

5.5.4 GENERAL

Table 11 lists the electrical characteristics of CSA314 (general). At T_A = 25°C, V_S = 5V, V_{CM} = 12V, V_{SENSE} = 100mV, R_L = 10kΩ to GND, $R_{PULL-UP}$ = 5.1kΩ each connected from CMP_{OUT} to V_S, and CMP_{IN} = 1V, unless otherwise noted.

Table 11. Electrical Characteristics (General)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
POWER SUPPLY						
Operating Power Supply	V_S	T_A = −40°C to 125°C	2.7		5.5	V
Quiescent Current	I_Q	V_{OUT} = 2V		1.7	2	mA
		V_{SENSE} = 0mV， T_A = −40°C to 125°C			2.2	mA
Comparator Power-On Reset Threshold(1)				1.8		V
TEMPERATURE						
Specified Temperature			−40		125	°C
Operating Temperature			−55		150	°C
Storage temperature			−65		150	°C

Note: The CSA314 is designed to power up with the comparator in a defined reset state as long as $\overline{\text{RESET}}$ is open or grounded. The comparator is in reset as long as the power supply is below the voltage shown here. The comparator assumes a state based on the comparator input above this supply voltage. If $\overline{\text{RESET}}$ is high at power-up, the comparator output comes up high and requires a reset to assume a low state, if appropriate.

6. TYPICAL CHARACTERISTICS

T_A = 25°C, V_S = 5V, V_{IN+} = 12V, and V_{SENSE} = 100mV, unless otherwise noted.

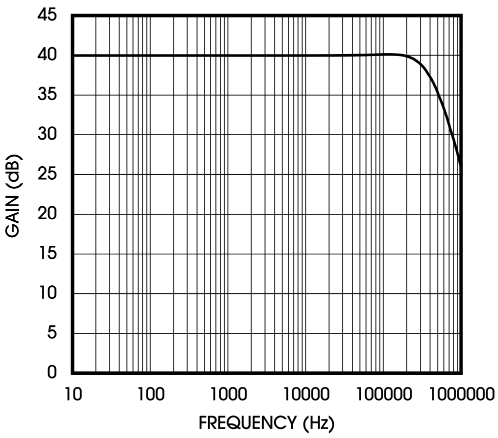


Figure 3. Bandwidth vs. Frequency

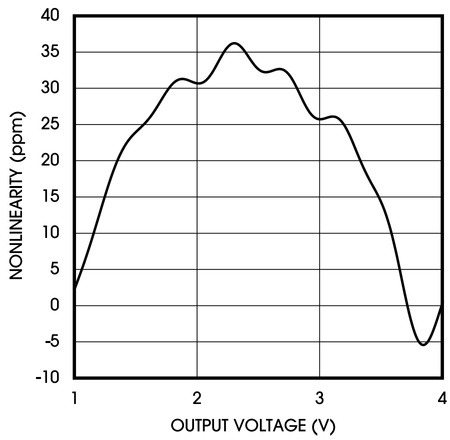


Figure 4. Nonlinearity vs. Output Voltage

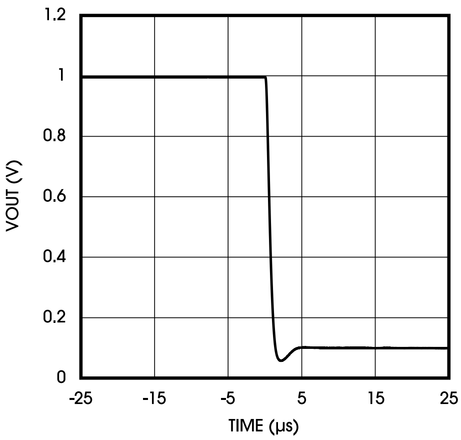


Figure 5. Settling Time Tfalling

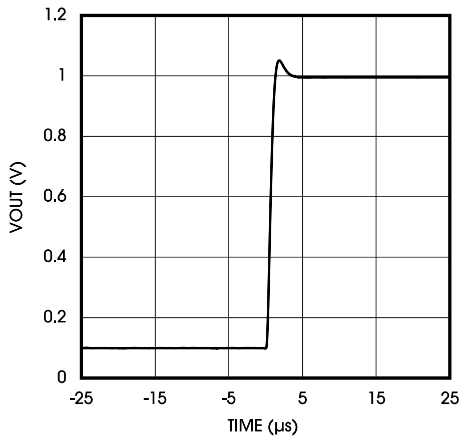


Figure 6. Settling Time Traising

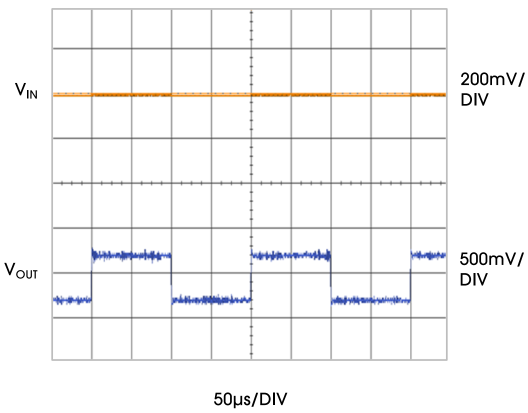


Figure 7. Small Signal Transient

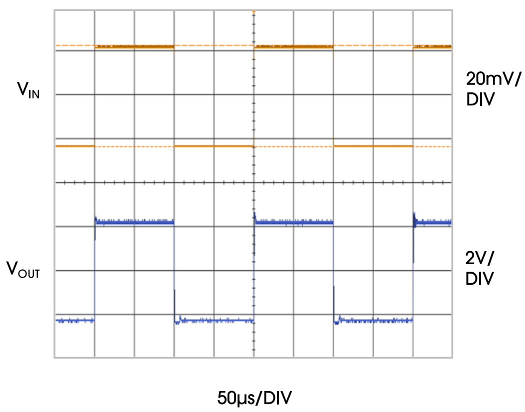


Figure 8. Large Signal Transient

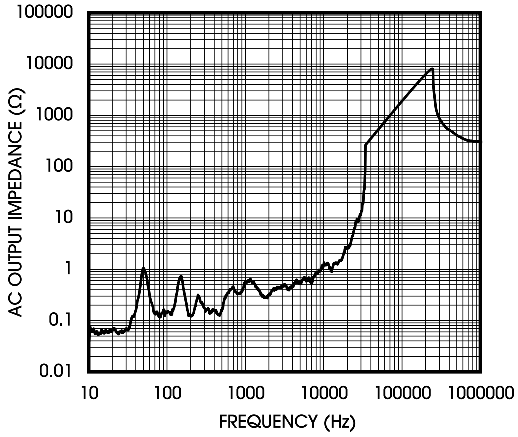


Figure 9. AC Output Impedance

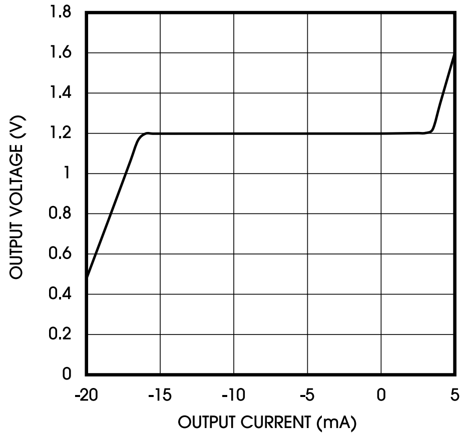


Figure 10. Load Regulation

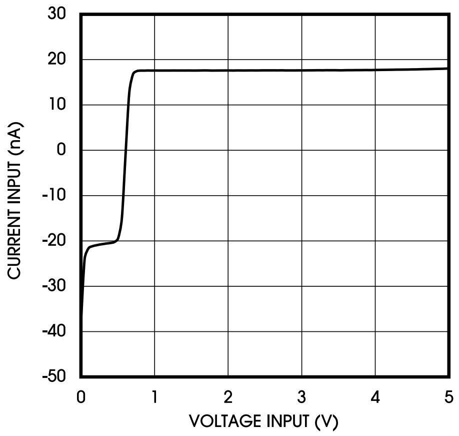


Figure 11. Impedance of Comparator In+

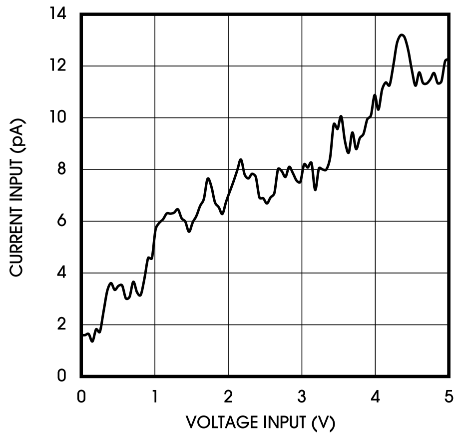


Figure 12. Impedance of $\overline{\text{RESET}}$ Pin

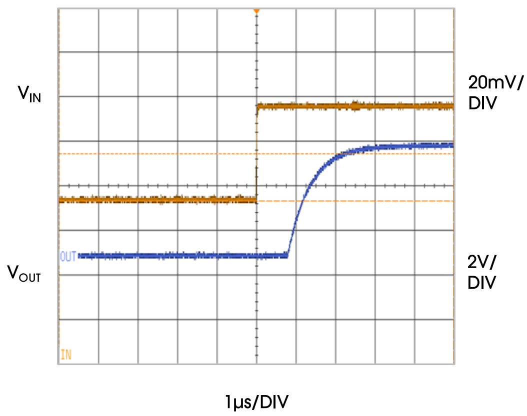


Figure 13. Comparator Propagation Delay Traising

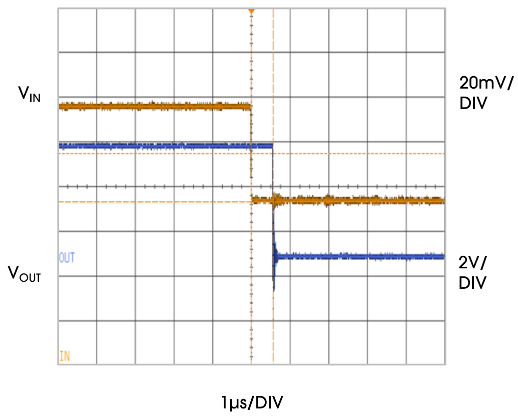


Figure 14. Comparator Propagation Delay Tfalling

7. 详细说明

7.1 概述

CSA314 器件是具有电压输出的高边电流分流监控器。CSA314 器件可以感测–6V 至 80V 共模电压下分流器上的压降。CSA314 器件提供三种输出电压范围：20V/V、50V/V 和 100V/V，带宽高达 420kHz。CSA314 器件包含一个开漏输出的比较器和提供 0.6V 阈值的内部基准。外部分压器设置电流跳变点。比较器具有锁存功能，可通过将$\overline{\text{RESET}}$引脚接地(或保持开路)来使其透明。CSA314 器件采用 2.7V 至 5.5V 单电源供电，最大消耗 2mA 的电源电流。封装为 MSOP-8。所有版本的额定温度范围为–40°C 至+125°C。

7.2 功能模块框图

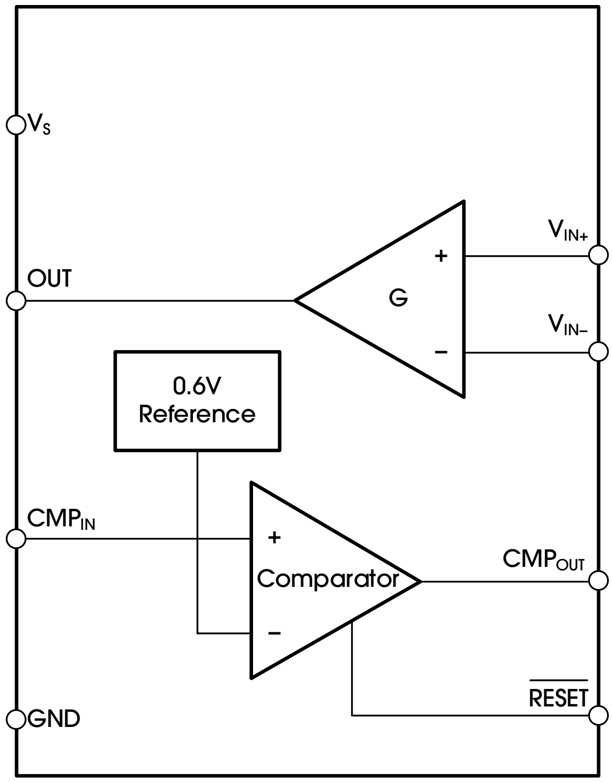


Figure 15. Functional Block Diagram

7.3 特性描述

7.3.1 基本连接

Figure 16 显示了 CSA314 器件的基本连接。输入引脚(V_{IN+}和 V_{IN-})必须通过开尔文连接尽可能紧密地连接到分流电阻，以最大限度地减少与分流电阻串联的任何电阻。

为了保持稳定性，需要电源旁路电容器。具有噪声或高阻抗电源的应用可能需要额外的去耦电容器来抑制电源噪声。将旁路电容器连接到靠近器件引脚的位置。

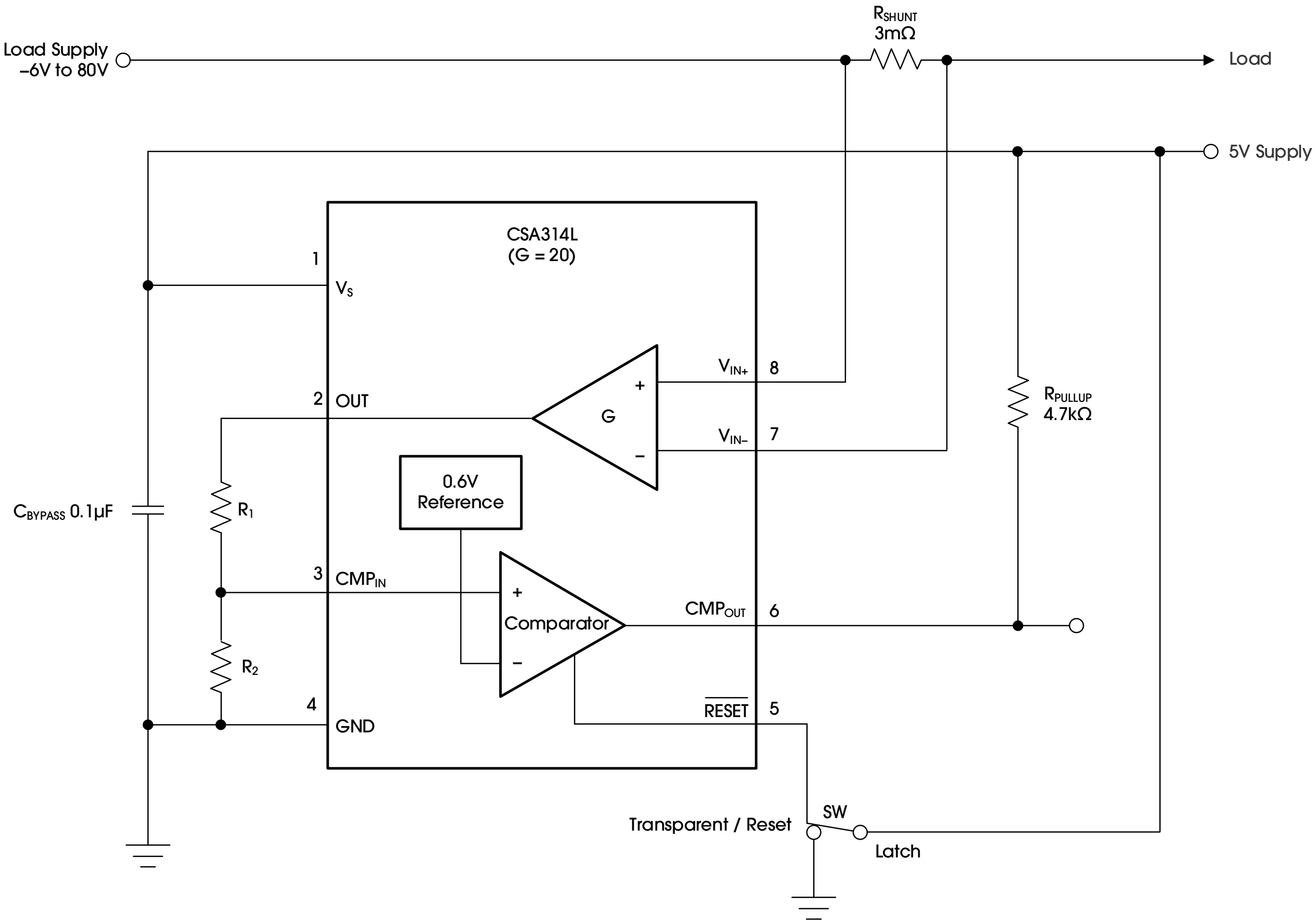


Figure 16. Basic Connections

7.3.2 选择 R_S

分流电阻器 R_S 的选定值取决于应用，并且是小信号精度和测量线路中最大允许电压损耗之间的折衷。高 R_S 值可最大限度地减少偏移影响，从而在较低电流下提供更高的精度，而低 R_S 值可最大限度地减少电源线中的电压损失。对于大多数应用，使用提供 50mV 至 100mV 满量程分流电压范围的 R_S 值可获得最佳性能。精确测量的最大输入电压为 500mV，但输出电压受电源限制。

 Public

7.3.3 比较器

CSA314 器件包含一个开漏输出的比较器。该比较器通常具有 1mV 偏移和 1μs (典型值)响应时间。比较器的输出锁存并通过RESET引脚复位；参见 Figure 17。

当 V_S 和RESET不同时，建议在RESET引脚上添加一个低通滤波器(LPF)。参见 Figure 18。

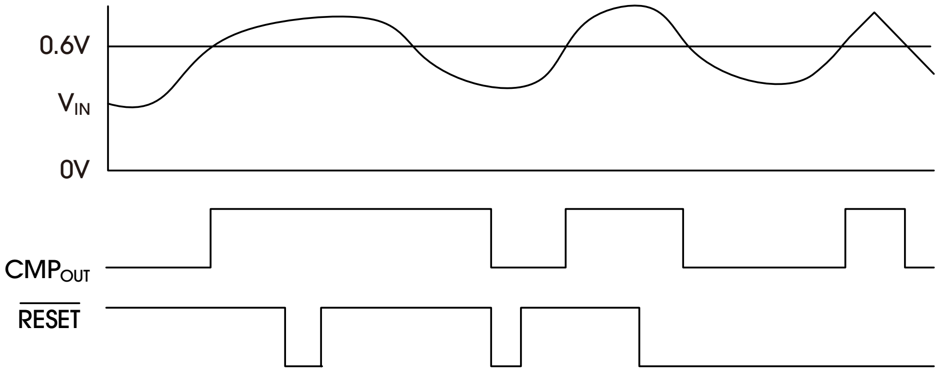


Figure 17. Comparator Latching Capability

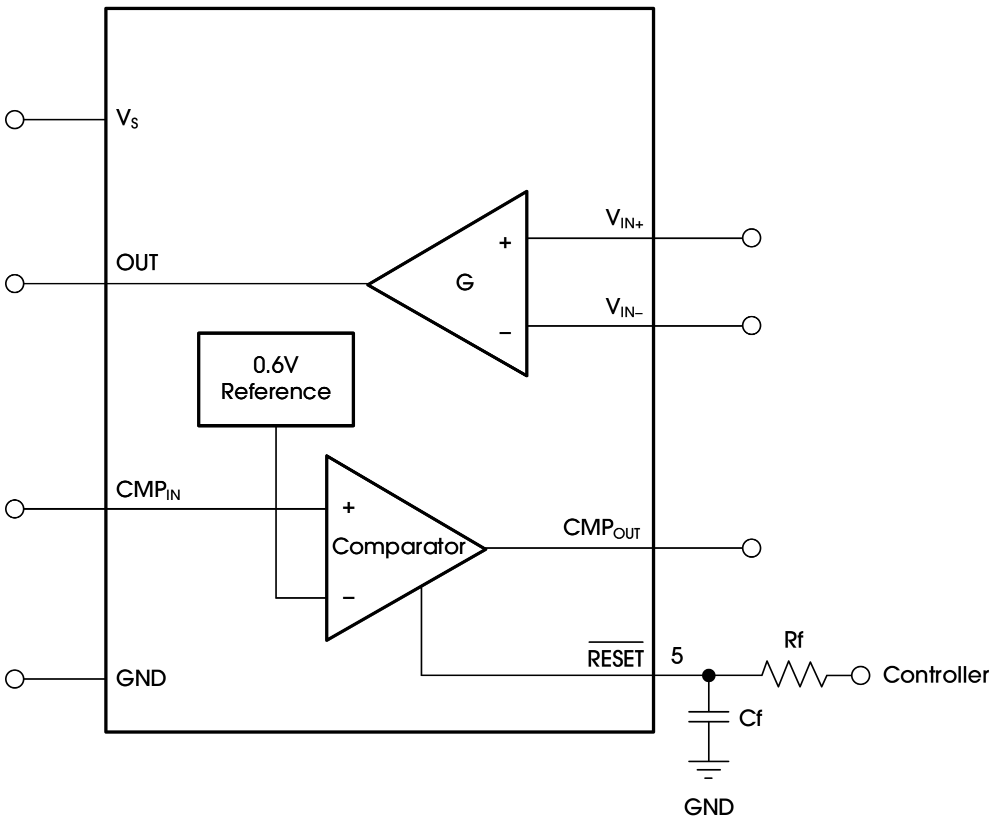


Figure 18. Filter on RESET Pin

7.4 器件功能模式

7.4.1 输入过滤

CSA314 系列的输出端是一个明显且直接的滤波位置；然而，这个位置抵消了内部缓冲器的低输出阻抗的优势。唯一的其他滤波选项位于 CSA314 器件的输入引脚，这因内部 5kΩ + 30%输入阻抗而变得复杂。如 Figure 19 所示。使用尽可能低的电阻值可以最大限度地减少增益的初始变化和容差的影响。对初始增益的影响如 Equation 1 所示：

$$\text{Gain Error \%} = 100 - \left(100 \times \frac{5k\Omega}{5k\Omega + R_{FILT}}\right) \tag{1}$$

对增益误差的总影响可以通过将 5kΩ 项替换为 5kΩ – 30% (或 3.5kΩ)或 5kΩ + 30% (或 6.5kΩ)来计算。R_{FILT} 的公差极值可以代入公式中。如果输入上使用一对 100Ω 1%电阻器，则初始增益误差等于 1.96%。最坏情况的容差条件总是发生在内部 5kΩ 电阻器(3.5kΩ)的较低偏移处，以及在这种情况下 R_{FILT} – 3%的较高偏移处。

除了这些容差之外，还必须结合 CSA314 器件的指定精度。虽然本讨论通过组合电阻器值的极值来处理精度最坏情况，但使用几何平均值或和平方根计算来计算精度变化的影响是适当的。

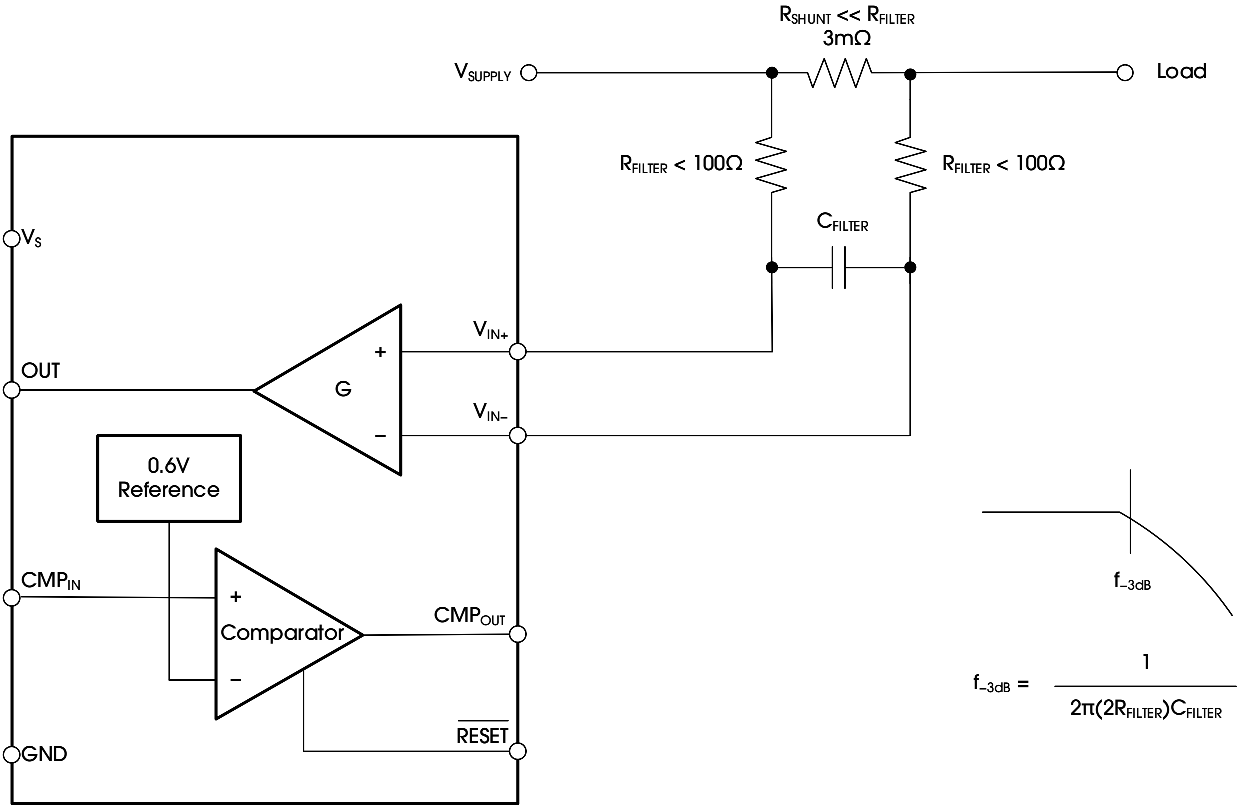


Figure 19. Input Filter (Gain Error: 1.5% to 2.8%)

7.4.2 瞬态保护

CSA314 器件的–6V 至 80V 共模范围非常适合承受从 12V 电池反转到 80V 瞬态的故障条件，因为达到这些级别不需要额外的保护组件。如果 CSA314 器件的输入瞬态超出其额定值，则需要使用半导体瞬态吸收器(例如齐纳二极管)进行外部瞬态吸收。不建议使用 MOV 或 VDR，除非它们与半导体瞬态吸收器一起使用。选择瞬态吸收器，使吸收器不允许 CSA314 器件暴露于大于 80V 的瞬态(即，允许瞬态吸收器容差和由于瞬态吸收器动态阻抗而产生的额外电压)。尽管使用内部齐纳型 ESD 保护，CSA314 器件仍不适合使用与输入串联的外部电阻，因为内部增益电阻的变化可达±30%。(如果增益精度不重要，则可以与 CSA314 输入串联添加电阻，每个输入上有两个相等的电阻。)

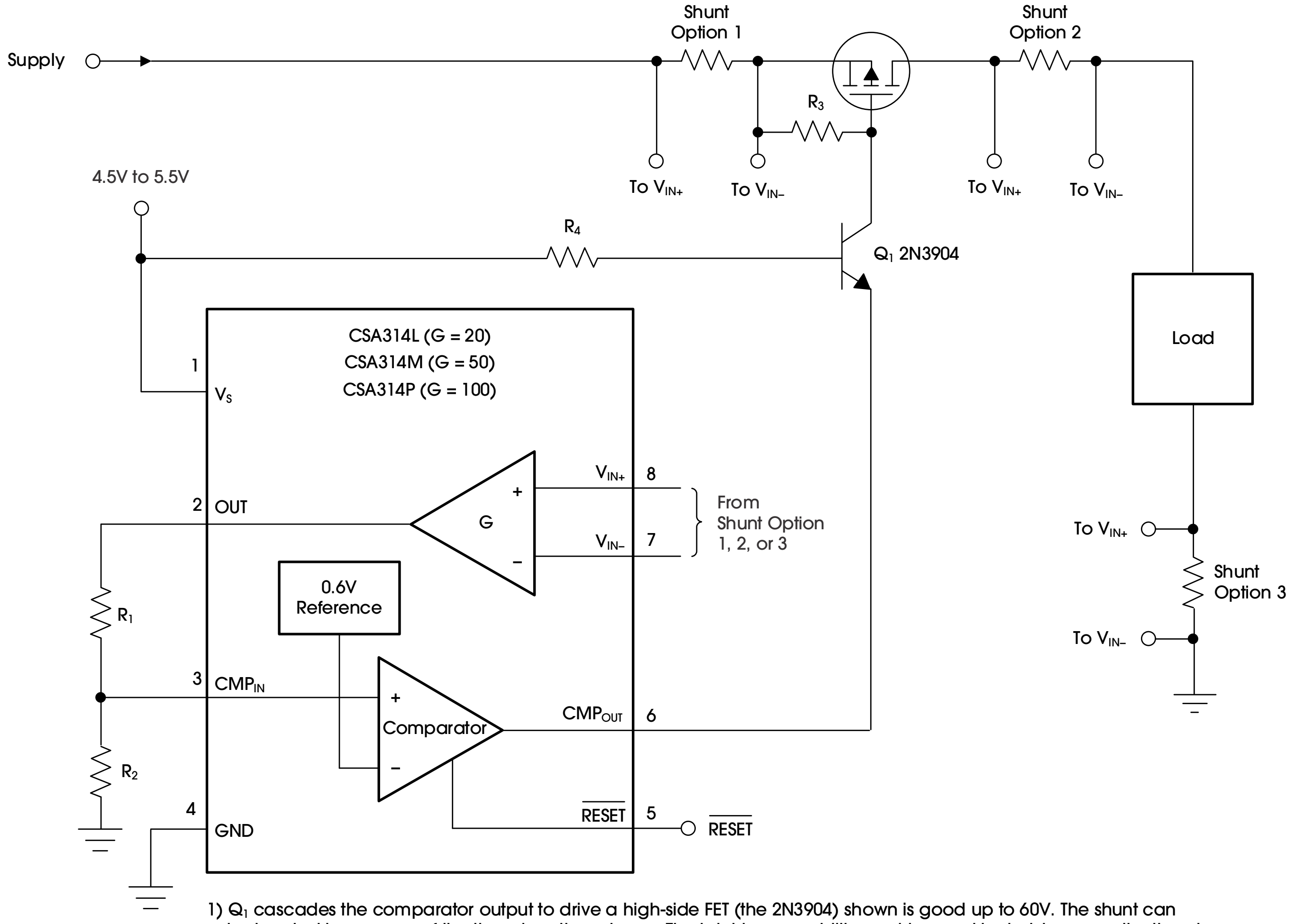
 Public

8. 电源供应推荐

CSA314 器件的输入电路可以精确测量超出电源电压 V_S 的电压。例如，V_S 电源为 5V，而负载电源电压最高为 80V。但是，OUT 引脚的输出电压范围受到电源引脚电压的限制。

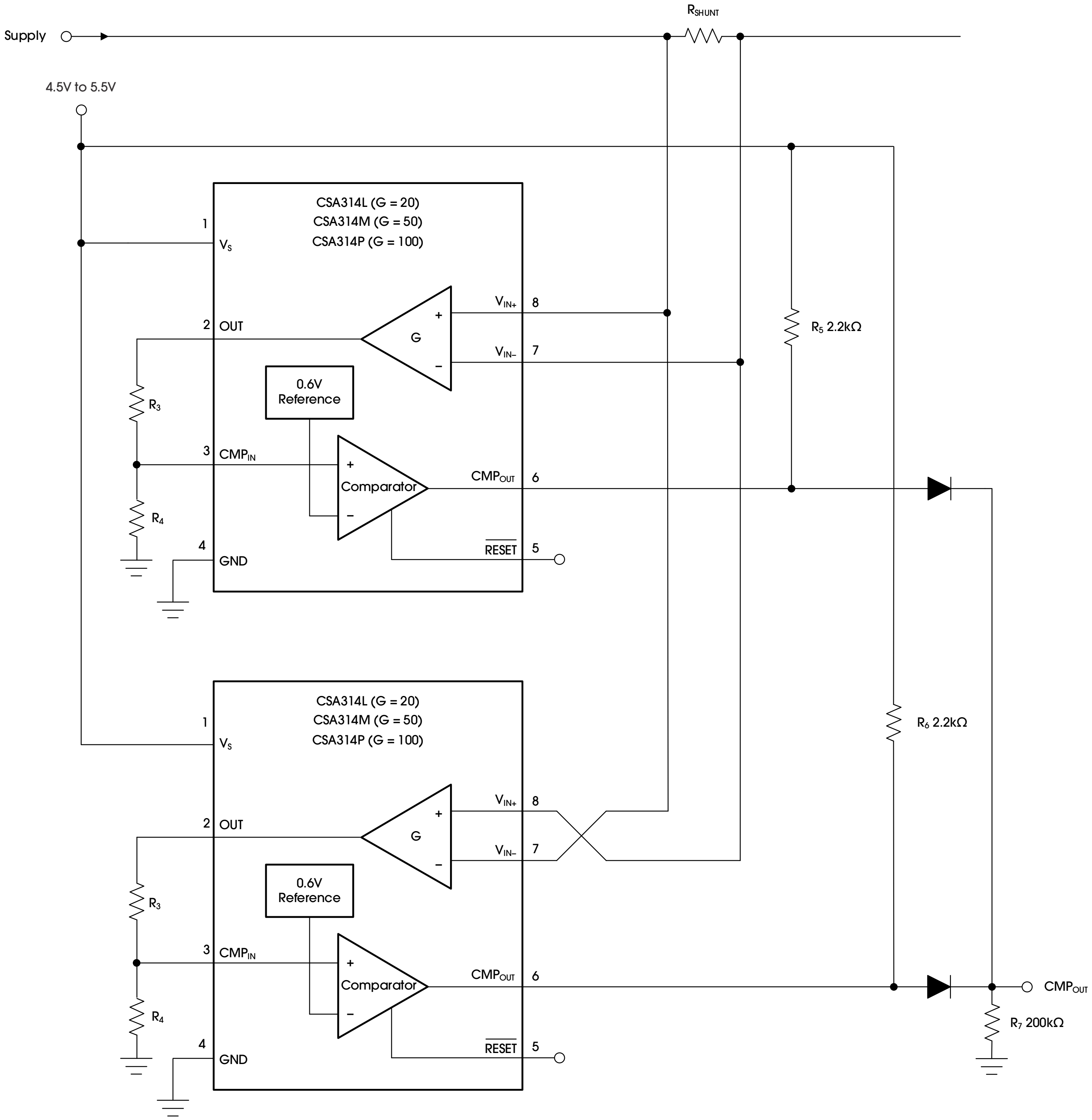
8.1 过流保护的典型应用

Figure 20 和 Figure 21 展示了单向和双向电源过流保护的典型应用。



1) Q_1 cascades the comparator output to drive a high-side FET (the 2N3904) shown is good up to 60V. The shunt can be located in any one of the three locations shown. The latching capability must be used in shutdown applications to prevent oscillation at the trip point.

Figure 20. High-Side Switch Overcurrent Shutdown



1) It is possible to set different limits for each direction.

Figure 21. Bidirectional Overcurrent Comparator

9. 布局

9.1 布局指南

- 使用开尔文连接或 4 线连接将输入引脚连接至传感电阻。这种连接技术可确保仅检测输入引脚之间的电流检测电阻器阻抗。电流检测电阻器的不良布线通常会导致输入引脚之间出现额外的电阻。鉴于电流电阻器的欧姆值非常低，任何额外的高载流阻抗都会导致显着的测量误差。
- 电源旁路电容器必须尽可能靠近电源和接地引脚放置。该旁路电容的推荐值为 0.1μF。可以添加额外的去耦电容来补偿噪声或高阻抗电源。

9.2 布局示例

请参考 EVM 或者咨询公司销售支持。

10. PACKAGE INFORMATION

The CSA314 is available in the MSOP-8 package. Figure 22 shows the package view.

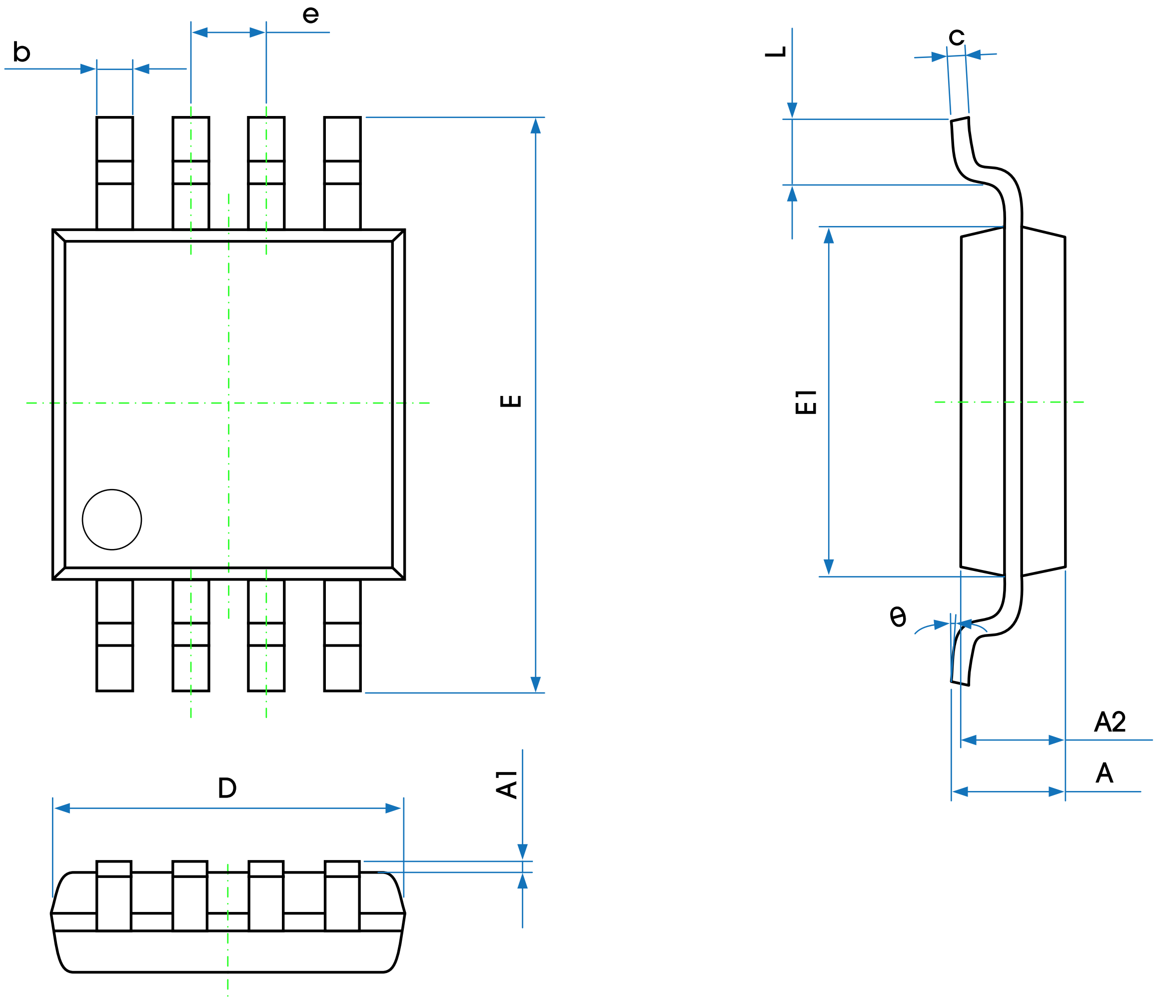


Figure 22. Package View

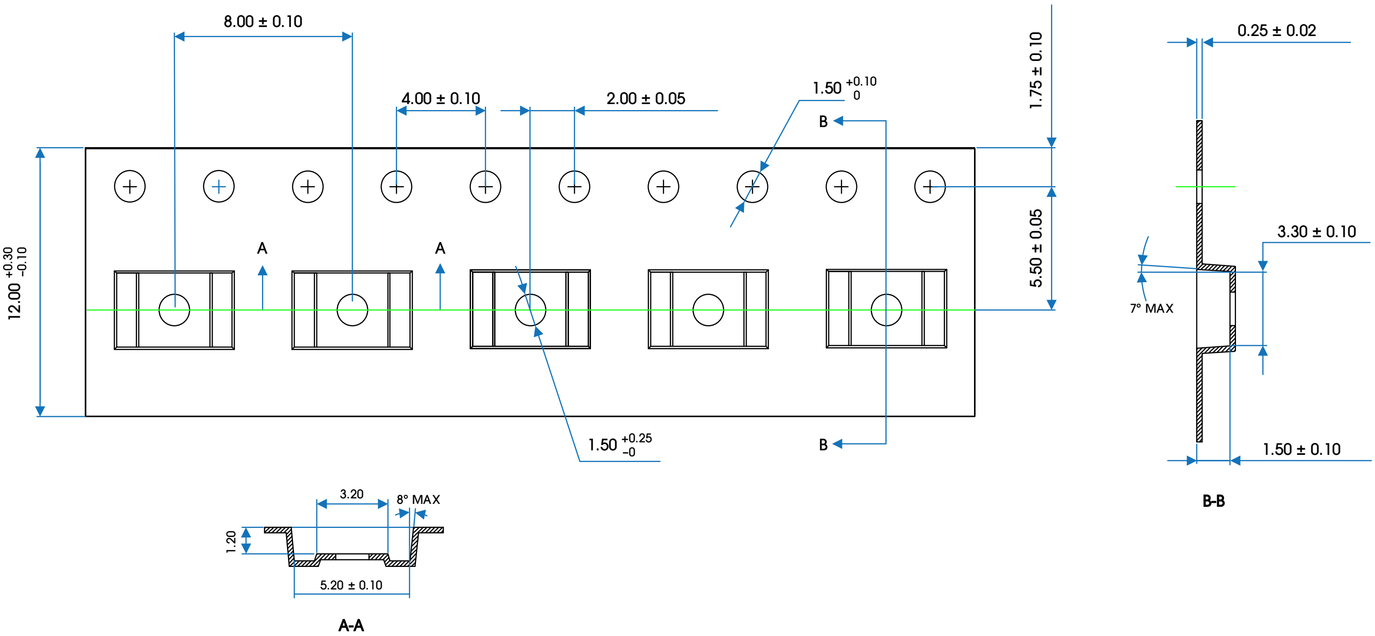
Table 12 provides detailed information about the dimensions.

Table 12. Dimensions

SYMBOL	DIMENSIONS IN MILLIMETERS		DIMENSIONS IN INCHES	
	MIN	MAX	MIN	MAX
A	—	1.100	—	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.650 (BSC)		0.026 (BSC)	
E	4.750	5.050	0.187	0.199
E1	2.900	3.100	0.114	0.122
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

 Public

11. TAPE AND REEL INFORMATION



Notes:
1. Cover tape width: 9.5 ± 0.10.
2. Cumulative tolerance of 10 sprocket hole pitch: ±0.20 (max).
3. Camber: not to exceed 1mm in 100mm.
4. Mold#: MSOP-8.
5. All dimensions: mm.
6. Direction of view:

Figure 23. Carrier Tape Drawing

Table 13 provides information about tape and reel.

Table 13. Tape and Reel Information

PACKAGE TYPE	REEL	QTY/REEL	REEL/ INNER BOX	INNER BOX/ CARTON	QTY/CARTON	INNER BOX SIZE (MM)	CARTON SIZE (MM)
MSOP-8	13''	4000	1	8	32000	358*340*50	430*380*390

Figure 24 shows the product loading orientation—pin 1 is assigned on the upper left corner.

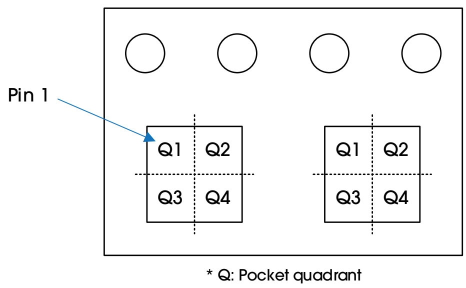


Figure 24. Product Loading Orientation

REVISION HISTORY

REVISION	DATE	DESCRIPTION
Rev A	08 May 2024	Rev A release.

