

Low cost high-side current sense amplifier

Features

- Independent supply and input common-mode voltages
- Wide common-mode operating range: 2.8 V to 24 V
- Wide supply voltage range: 4 to 24 V
- Low current consumption: I_{CC} max = 1 mA
- Internally fixed gain: 20 V/V, 50 V/V or 100 V/V
- Buffered output

Applications

- Desktop computers and servers SMPS
- Photovoltaic/solar systems
- Battery chargers
- Notebook computers
- DC motor control

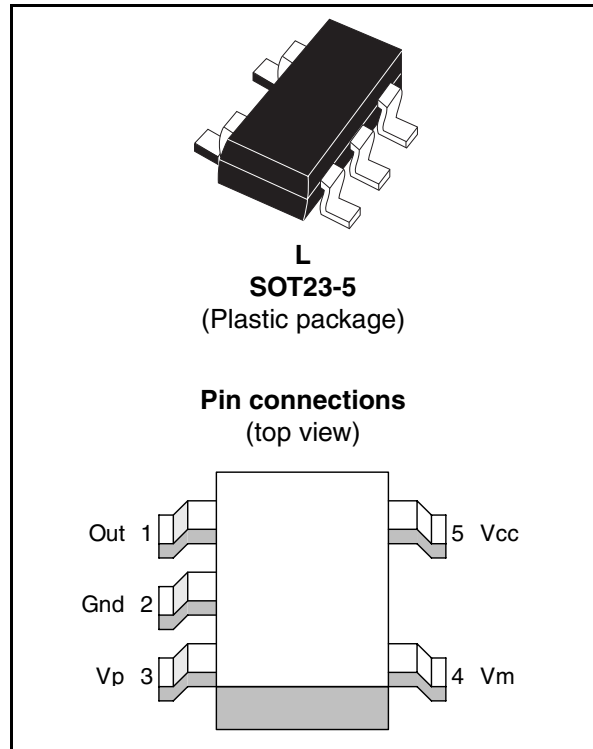
Description

The TSC888 measures a small differential voltage on a high-side shunt resistor and translates it into a ground-referenced output voltage. The gain is internally fixed.

Wide input common-mode voltage range, low quiescent current, and tiny SOT23-5 packaging make the TSC888 ideal for use in a wide variety of applications.

Input common-mode and power supply voltages are independent. Common-mode voltage can range from 2.8 V to 24 V in operating conditions.

Current consumption lower than 1 mA and wide supply voltage range allow to connect the power supply to either side of the current measurement shunt with minimal error.



1 Application schematics and pin description

The TSC888 high-side current-sense amplifier features a 2.8 V to 24 V input common-mode range that is independent of supply voltage. The main advantage of this feature is to allow high-side current sensing at voltages much greater than the supply voltage (V_{CC}). The TSC888 can therefore be supplied by a 5 Vsb line and monitor a 3.3 V, 5 V or 12 V power line. Considering the wide supply voltage operating range (4 V to 24 V) another option available in most cases is to connect the V_{CC} pin to the V_p pin.

Figure 1. Application schematics

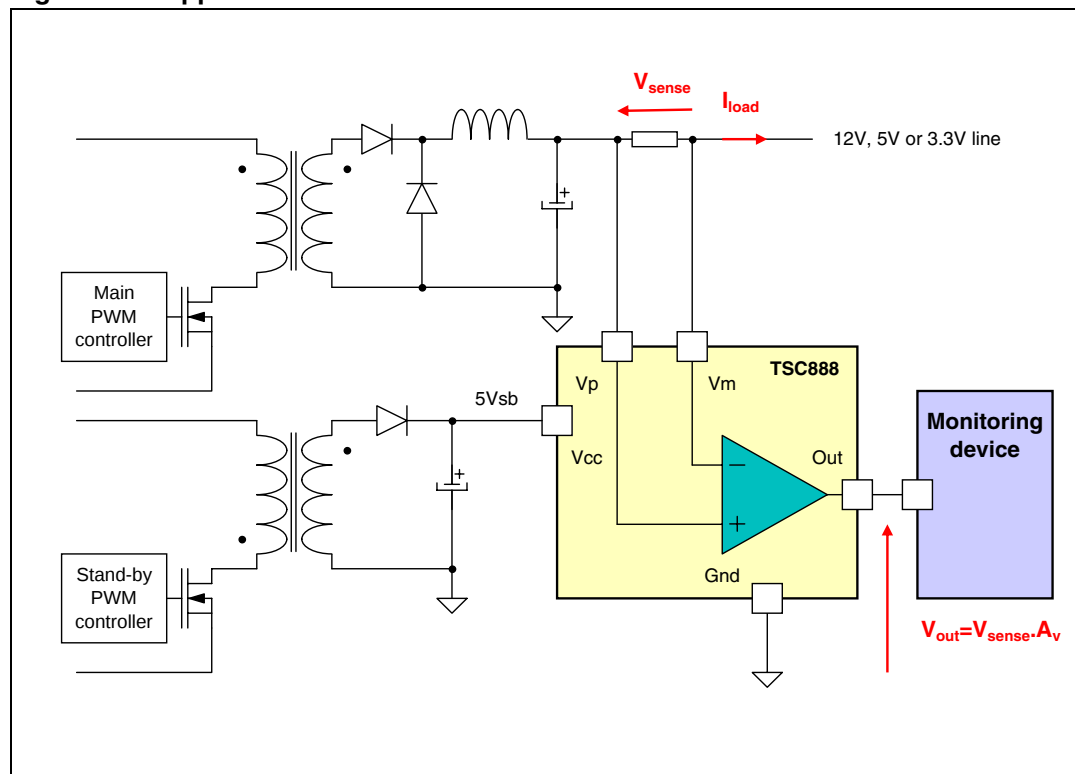


Table 1 describes the function of each pin. Their position is shown in the illustration on the cover page and in Figure 1 above.

Table 1. Pin description

Symbol	Type	Function
Out	Analog output	The out voltage is proportional to the magnitude of the sense voltage $V_p - V_m$.
Gnd	Power supply	Ground line.
Vcc	Power supply	Positive power supply line.
Vp	Analog input	Connection for the external sense resistor. The measured current enters the shunt on the V_p side.
Vm	Analog input	Connection for the external sense resistor. The measured current exits the shunt on the V_m side.

2 Absolute maximum ratings and operating conditions

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{id}	Input pins differential voltage ($V_p - V_m$)	± 2	V
V_{in}	Input pin voltages (V_p, V_m) ⁽¹⁾	-0.3 to 30	V
V_{CC}	DC supply voltage ⁽¹⁾	-0.3 to 25	V
V_{out}	DC output pin voltage ⁽¹⁾	-0.3 to V_{CC}	V
T_{stg}	Storage temperature	-55 to 150	°C
T_j	Maximum junction temperature	150	°C
R_{thja}	SOT23-5 thermal resistance junction to ambient	250	°C/W
ESD	Human body model (HBM) ⁽²⁾	1	kV
	Machine model (MM) ⁽³⁾	100	V

1. Voltage values are measured with respect to the Gnd pin.
2. Human body model: 100 pF discharged through a 1.5k Ω resistor between two pins of the device, done for all couples of pin combinations with other pins floating.
3. Machine model: a 200 pF cap is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5 Ω), done for all couples of pin combinations with other pins floating.

Table 3. Operating conditions

Symbol	Parameter	Value	Unit
V_{CC}	DC supply voltage from T_{min} to T_{max}	4.0 to 24	V
T_{oper}	Operational temperature range (T_{min} to T_{max})	-40 to 85	°C
V_{icm}	Common mode operating range	2.8 to 24	V

3 Electrical characteristics

The electrical characteristics given in the following tables are measured under the following test conditions unless otherwise specified:

$$T_{amb}=25^{\circ}\text{C}, V_{CC}=5\text{V}, V_{sense}=V_p-V_m=50\text{mV}, V_m=12\text{V}, \text{no load on Out}$$

Table 4. Supply

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CC}	Total supply current	$V_{sense} = 0$			1	mA

Table 5. Input

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
CMR	DC common mode rejection Variation of V_{out} versus V_{icm} referred to input	$2.8\text{V} < V_{icm} < 24\text{V}$ $V_{sense} = 30\text{mV}$		95		dB
SVR	Supply voltage rejection Variation of V_{out} versus V_{CC} referred to input	$4.0\text{V} < V_{CC} < 24\text{V}$ $V_{sense} = 30\text{mV}$		95		dB
I_{lk}	Input leakage current	$V_{CC}=0\text{V}$			1	μA
I_{ib}	Input bias current	$V_{sense}=0\text{V}$		5.5	8	μA

Table 6. Output

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
A_v	Gain	TSC888A TSC888B TSC888C		20 50 100		V/V
ΔV_{out}	Total output voltage accuracy				± 6	%
I_{sc}	Short-circuit current	OUT connected to V_{CC} or GND	2			mA
V_{OH}	Output stage high-state saturation voltage $V_{OH}=V_{CC}-V_{out}$	$V_{sense}=1\text{V}$ $I_{out}=1\text{mA}$		0.8	1	V
V_{OL}	Output stage low-state saturation voltage	$V_{sense}=-1\text{V}$ $I_{out}=1\text{mA}$		50	100	mV

4 Package information

In order to meet environmental requirements, STMicroelectronics offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an STMicroelectronics trademark. ECOPACK specifications are available at: www.st.com.

Figure 2. SOT23-5 package mechanical drawing

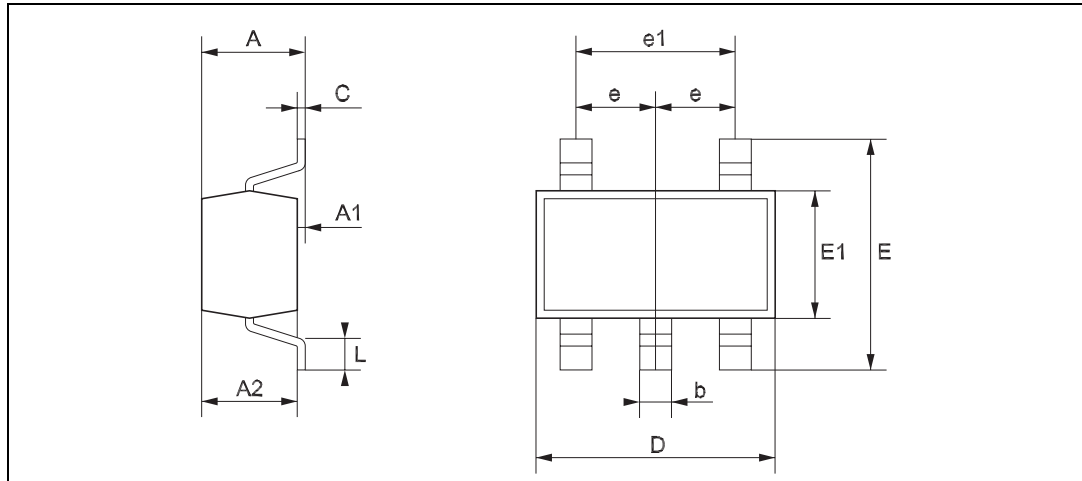


Table 7. SOT23-5 package mechanical data

Ref.	Dimensions					
	Millimeters			Mils		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.90		1.45	35.4		57.1
A1	0.00		0.15	0.00		5.9
A2	0.90		1.30	35.4		51.2
b	0.35		0.50	13.7		19.7
C	0.09		0.20	3.5		7.8
D	2.80		3.00	110.2		118.1
E	2.60		3.00	102.3		118.1
E1	1.50		1.75	59.0		68.8
e		0.95			37.4	
e1		1.9			74.8	
L	0.35		0.55	13.7		21.6

5 Ordering information

Table 8. Order codes

Order code	Temperature range	Package	Packaging	Marking	Gain
TSC888AILT	-40°C, +85°C	SOT23-5	Tape & reel	O111	20
TSC888BILT				O112	50
TSC888CILT				O113	100

6 Revision history

Table 9. Document revision history

Date	Revision	Changes
26-Jun-2008	Rev 1	Initial release.

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