

Design Note
UCC3926DS ± 20A Integrated Current Sensor, Evaluation Board and List of Materials

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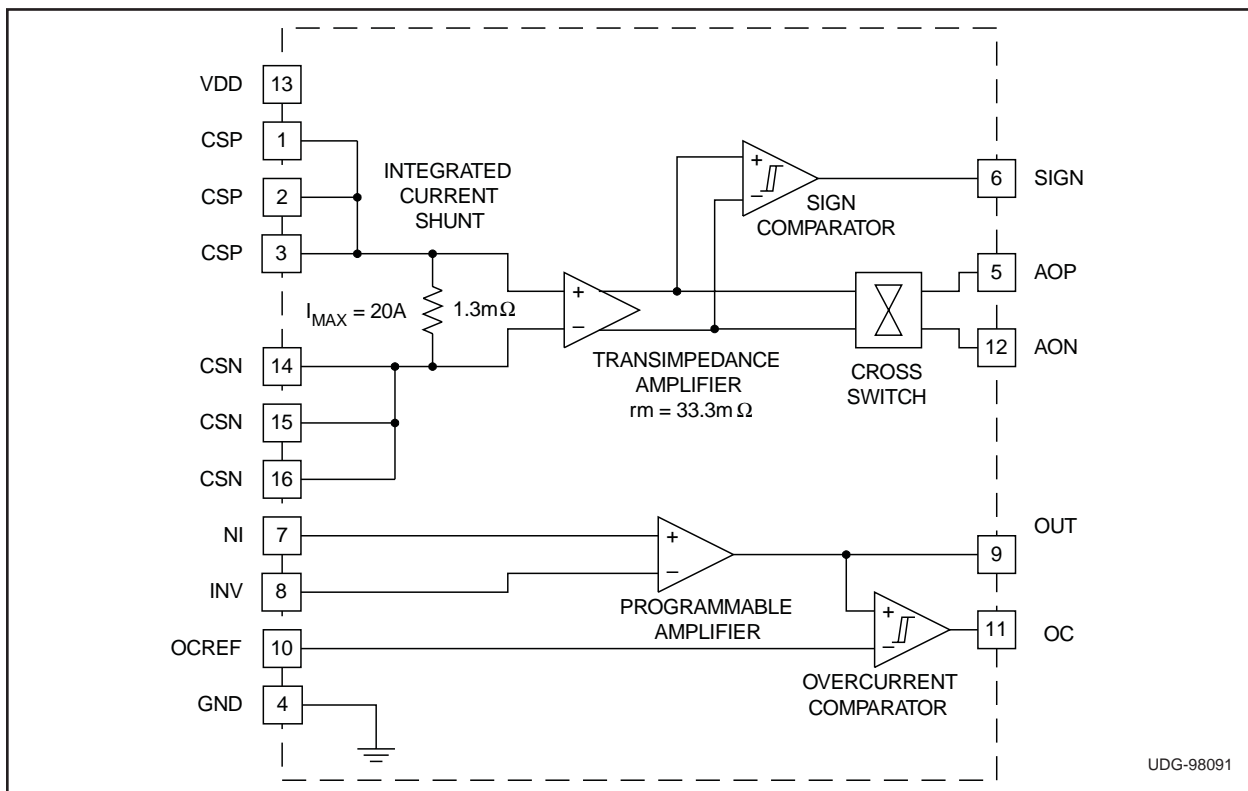
INTRODUCTION

The UCC3926 integrates a current sense element and differential amplifier into a single device and may be evaluated with this demonstration board. The current sense element is essentially non-inductive and is implemented as an integral part of an integrated circuit lead frame with only 1.3mΩ of resistance. All necessary voltage amplification is accomplished using a chopper stabilized transimpedance amplifier with Kelvin sense leads. A second uncommitted, user configurable, operational error amplifier provides common mode filtering and programmable voltage gain from the chopper amplifier stage. Over current indication is provided by an over current comparator with an adjustable threshold. Since the transimpedance amplifier provides the absolute value of the current, polarity is indicated by a sign comparator output, see Fig. 1.

OPERATING GUIDELINES

As shown in Fig. 2 the current sense terminals of the demonstration board are labeled CSP (TB1) and CSN (TB2) which connect to the external system in which current is to be measured. Shorting jumper J1 allows low side, GND referenced, current sensing. Similarly shorting jumper J2 allows high side, VDD referenced, current sensing. Only one jumper should be used, either J1 or J2, otherwise VDD is shorted to GND. Note that the operating common mode range of CSP and CSN is either VDD ±75mV or GND ±75mV. External power is supplied through connector TB3. Zener diode D1 provides a 4.3V reference for the multitrans pots R10 and R12.

The programmable amplifier gain is configured by selecting resistors R1, R2, R3, R4 (optional), R5, and R6 (optional). The gain is preset to one by us-


Figure 1. UCC3926 Block diagram.

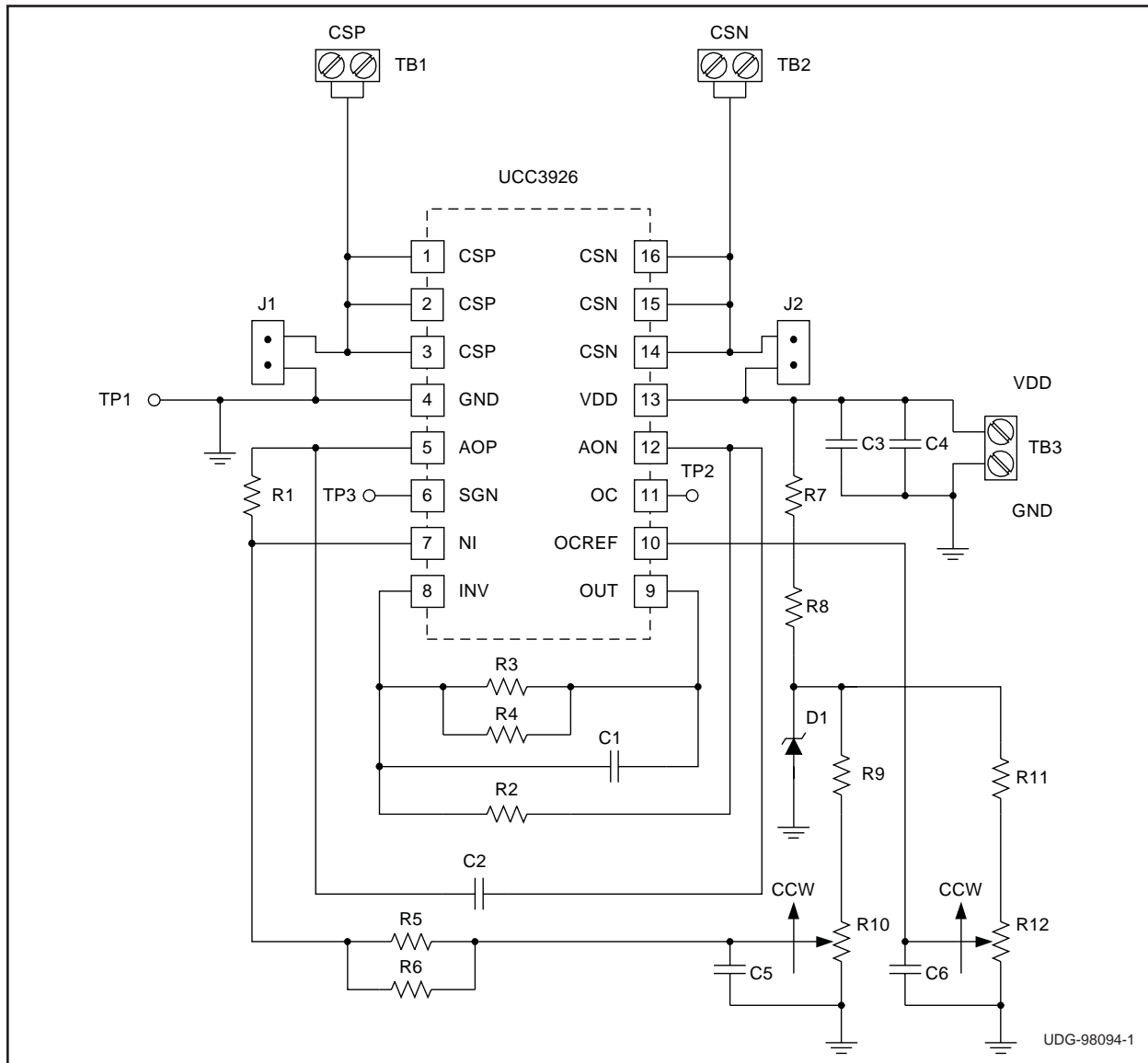


Figure 2. UCC3926 evaluation board schematic.

ing $R1=R2=R3=R5=5.9k\Omega$. It is prudent to use values below $10k\Omega$ to minimize noise coupling into the differential amplifier. $C1$ provides a high frequency noise pole which helps to reduce any differential mode chopper noise. Another optional capacitor, $C2$, filters spikes between AOP and AON. A non-inverting bias voltage can be used to offset the output of the programmable differential amplifier using $R10$.

The over current reference is set to the highest desired voltage as measured at pin 9 (OUT) by adjusting $R12$. Turning this pot counterclockwise (CCW) increases the OCREF voltage which increases the current limit level. The exact value de-

pends on the external gain used for the programmable amplifier in the application and is easily calculated by referring to Fig. 2 with the appropriate component value substitutions.

In normal operation there is some common mode, square-wave chopping, that is observed at AOP and AON with respect to GND. This is to be expected and the purpose of the differential amplifier stage is to reject this noise and transform the signal to GND reference.

For more complete information, pin descriptions and specifications for the UCC3926 ± 20A Integrated Current Sensor, please refer to the UCC3926 data sheet or contact your Unitrode Field Applications Engineer at (603) 424-2410.

Table 1. UCC3831 evaluation board list of materials.

Reference Designator	Description	Manufacturer	Part Number
R1,R2,R3,R4,R5,R6	5.90k Ω , 0603, 1/16W, \pm 1%	Panasonic, Digikey	P5.90KHCT-ND
R7,R8	412 Ω , 1206, 1/8W, \pm 1%	Panasonic, Digikey	P412FCT-ND
R9,R11	1k Ω , 0805, 1/10W, \pm 1%	Panasonic, Digikey	P1.00KCCT-ND
R10,R12	1k Ω , Multiturn Pot, Cermet, Thru Hole	Bourns, Digikey	3296Y-102-ND
C1,C2	100pF, 50V, 0603, NPO, \pm 5%	Xicon, Mouser	140-CC504N101J
C3	10 μ F, 16V, 3.5mm x 2.8mm, Tantalum	Panasonic, Digikey	PCS3106CT-ND
C4,C5,C6	0.027 μ F, 50V, 0805, X7R, \pm 10%	Xicon, Mouser	140-CC501B273K
D1	4.3V, SOD123, 410mW, Zener	Liteon, Digikey	BZT52-C4V3DICT-ND
J1,J2	Shorting Jumper, Thru Hole	3M, Digikey	929950-00-ND
U1	\pm 20A Integrated Current Sensor	Unitrode	UCC3926DS

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