

## 1mA Current Source Reference Design

The diode temperature sensors on the TTC-1001 (1mm X 1mm Unit Cell) and TTC-1002 (2.54mm X 2.54mm Unit Cell) Thermal Test Chips are optimized for use with a 1.00mA current source. There are commercially available instrumentation units available for this application but the cost of these units and relative difficulty in using them at low current levels make the units a non-optimal solution in most instances.

The electrical circuit shown in Figure 1 below is relatively simple in design and implementation. The circuit is divided into two parts:

### 1) Current Source

The right circuit portion consists of two semiconductor devices – a three terminal integrated circuit (IC) and a diode – and three resistors. The IC is a current regulator optimized for low current operation. The diode provides some degree of temperature compensation so the current will remain relatively constant over the temperature ranges usually found in laboratories. The three resistors set the current source level. The potentiometer (R3) has enough range to set the current level to exactly 1.00mA. As shown, the current source operates from a 5V source. While it is possible to use higher voltage sources, the 5V level provides the current source with enough voltage compliance (>2V) to insure the diode is properly biased at 1mA but not enough voltage compliance if the diode is inadvertently reverse biased during the measurement setup.

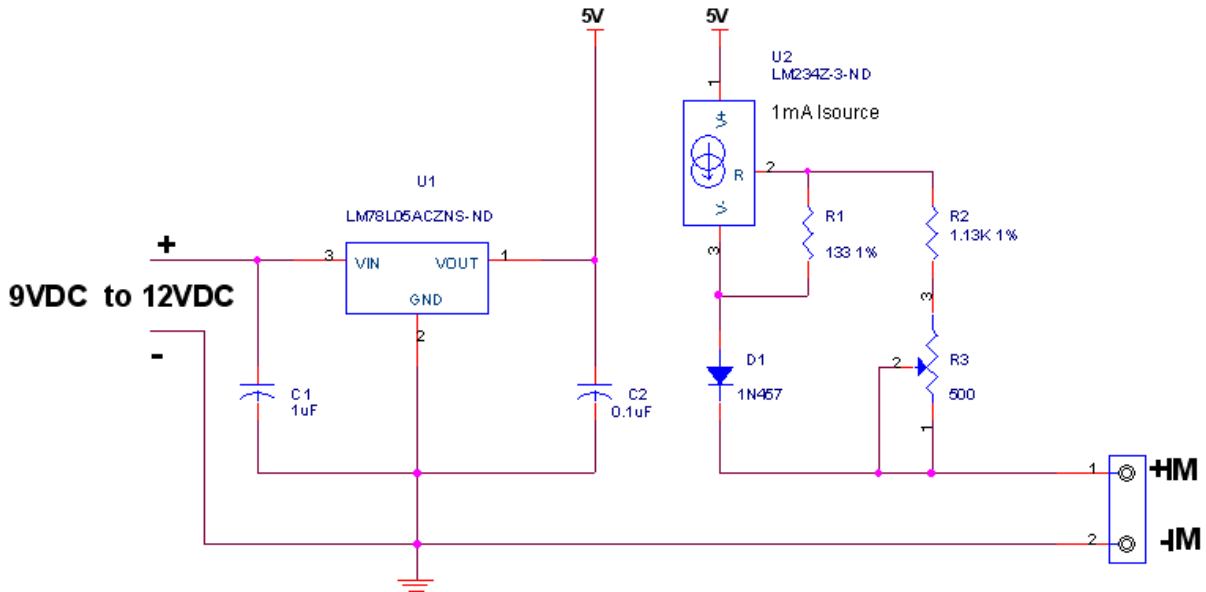


Figure 1 1mA Current Source Reference Circuit

## 1mA Current Source Reference Design (cont'd)

### 2) Power Supply

If a clean (i.e., low noise, ripple-free) 5V source is not available, the left circuit portion provide a power supply solution. Consisting of a three-terminal 5V regulator IC and two capacitors, this portion of the circuit shown should be in close proximity to the current source circuit to minimize electrical noise pickup. The combination of the two ICs (U1 and U2) provides sufficient rejection of voltage level variations and electrical noise. Input to this portion is any voltage between 9V and 12V, easily obtainable from a 9V battery (for short duration measurements) or a 12V power supply (such as a wall-outlet-mounted module). The total power supply input current requirement is less than 25mA.

Table 1 below provides a Bill Of Material (BOM) for the reference circuit.

Ref	Description	Manufacturer	Part #	Digi-Key #
U1	IC, VREG, LM78L05A, 5V, TO-92	TI	LM78L05ACZ/NOPB	LM78L05ACZNS-ND
U2	IC, CURRENT SOURCE, LM234, TO-92	TI	LM234Z-3/NOPB	LM234Z-3-ND
D1	DIODE, 1N457, 70V, 200mA, DO35	Fairchild	1N457TR	1N457CT-ND
C1	CAP, TANT, 1.0uF, 25V	KEMET	T350A105K025AT	399-3528-ND
C2	CAP, 0.1uF, CER, XR7, 50V, 10%, RAD 0.1"	VISHAY/BC	K104K15X7RF5TL2	BC1084CT-ND
R1	RES, MF, 133 OHMS, 1%, 1/4W	YAGEO	MFR-25FBF-133R	133XBK-ND
R2	RES, MF, 1.13K OHMS, 1%, 1/4W	YAGEO	MFR-25FBF-1K13	1.13KXBK-ND
R3	TRIMMER, 25 TURN, 500 OHMS, VERT	BOURNS	3296W-1-501LF	3296W-501LF-ND

**Table 1 1mA Current Source Reference Circuit BOM**

DISCLAIMER: The reference circuit and associated bill of material herein are provided for the general information of TEA customers without warranty as to performance or material availability. TEA is not responsible for the reference design implementation, performance or use.