[DC Precision Constant-Current Sink]

Figure 10-14. Precision Current Limiter

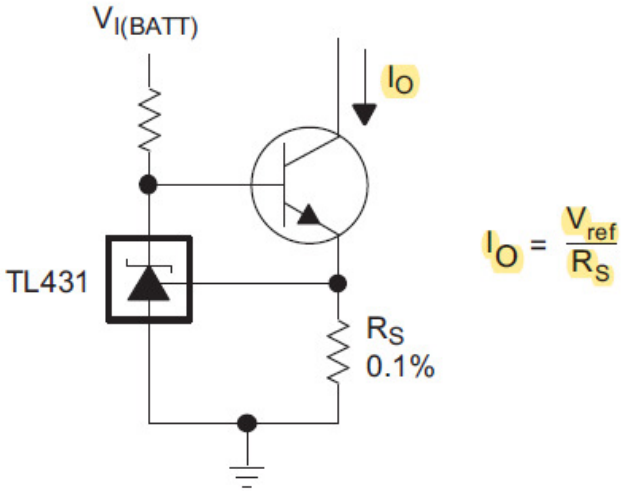

Figure 10-15. Precision Constant-Current Sink

[Solution Explanation]

1, DC pulse mode(duty cycle = 50%) constant current(10mA,RMS) generator = pulse generator(1~1KHz) + high voltage amplifier + TL431 adjustable shunt regulators.

2, Use TI TL431A, 1% (A grade), Vref = 2.5V (approximately)

3, We use a NPN transistor as the constant current control switch, this transistor is selected with "**BTC3906N3**".

4, We will design in with both "Pulse Mode Constant Current DC 10mA" and "Normal Mode Constant Current DC 10mA" dual modes at the same time.

5, For "Pulse Mode Constant Current DC 10mA" :

6, Due to the pulse-mode(duty cycle = 50%) dc constant current = 10mA(True RMS), so we must set the pulse-mode Io = 20mA, Vi = DC5V (TI 78L05 output).

7, We define the Iz is the dc current which comes from 78L05 output and flow into the cathode of TL431, pass through TL431 and output from the anode, flow into ground.

8, So we **set Iz = 3mA**, Rz is defined to be the current limited resistor which limits the current into TL431.

9, (Calculation)

9.1, Io = Vref / Rs , ➔ **Rs** = Vref / Io = 2.5V / 20mA = **125 Ohm** (1% tolerance)

9.2, Due to Vz-Vbe-Vs = 0, so **Vz** = Vbe + Vs = Vbe + Io * Rs = Vbe + Vref = Vbe + 2.5V = **1V** + 2.5V = **3.5 V**

9.3, Due to Vi – Vz = Iz * Rz, so **Rz** = (Vi – Vz) / Iz = **500 Ohm**

10, For "Normal Mode Constant Current DC 10mA" :

11, DC constant current = 10mA(True RMS), so we set the Io = 10mA, Vi = DC5V (TI 78L05 output).

12, We define the Iz is the dc current which comes from 78L05 output and flow into the cathode of TL431, pass through TL431 and output from the anode, flow into ground.

13, So we **set Iz = 3mA**, Rz is defined to be the current limited resistor which limits the current into TL431.

14, (Calculation)

14.1, Io = Vref / Rs , ➔ **Rs** = Vref / Io = 2.5V / 10mA = **250 Ohm** (1% tolerance)

14.2, Due to Vz-Vbe-Vs = 0, so **Vz** = Vbe + Vs = Vbe + Io * Rs = Vbe + Vref = Vbe + 2.5V = **1V** + 2.5V = **3.5 V**

14.3, Due to Vi – Vz = Iz * Rz, so **Rz** = (Vi – Vz) / Iz = **500 Ohm**