5.6 IC 723 – GENERAL PURPOSE REGULATOR

Disadvantages of fixed voltage regulator:

1. Do not have the shot circuit
2. Output voltage is not adjustable

These limitations can be overcomes in IC723.

Features of IC723:

1. Unregulated dc supply voltage at the input between 9.5V & 40V
2. Adjustable regulated output voltage between 2 to 3V.
3. Maximum load current of 150 mA (ILmax = 150mA).
4. With the additional transistor used, ILmax upto 10A is obtainable.
5. Positive or Negative supply operation
6. Internal Power dissipation of 800mW.
7. Built in short circuit protection.
8. Very low temperature drift.
9. High ripple rejection.

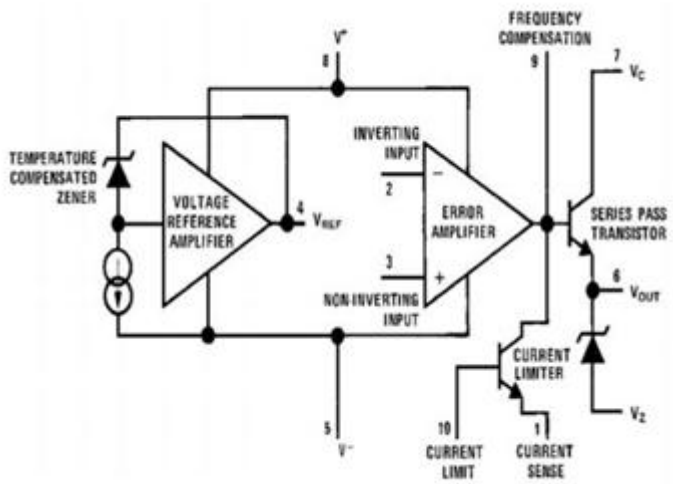

Figure 5.6.1 Functional block diagram of IC723

[source: https://www.brainkart.com/subject/Linear-Integrated-Circuits_220/]

Functional block diagram of IC723 is shown in figure 5.6.1.The simplified functional block diagram can be divided in to 4 blocks.

1. Reference Generating block:

The temperature compensated Zener diode, constant current source & voltage reference amplifier together from the reference generating block. The Zener diode is used to generate a fixed reference voltage internally. Constant current source will make the Zener diode to operate at affixed point & it is applied to the Non – inverting terminal of error amplifier. The Unregulated input voltage ±Vcc is applied to the voltage reference amplifier as well as error amplifier.

2. Error Amplifier:

Error amplifier is a high gain differential amplifier with 2 input (inverting & Non-inverting). The Non-inverting terminal is connected to the internally generated reference voltage. The Inverting terminal is connected to the full regulated output voltage.

3. Series Pass Transistor:

Q1 is the internal series pass transistor which is driven by the error amplifier. This transistor actually acts as a variable resistor & regulates the output voltage. The collector of transistor Q1 is connected to the Un-regulated power supply. The maximum collector voltage of Q1 is limited to 36Volts. The maximum current which can be supplied by Q1 is 150mA.

4. Circuitry to limit the current:

The internal transistor Q2 is used for current sensing & limiting. Q2 is normally OFF transistor. It turns ON when the IL exceeds a predetermined limit.Low voltage, Low current is capable of supplying load voltage which is equal to or between 2 to 7Volts.Pin diagram of IC723 in figure 5.6.2.

$$V_{load} = 2 \text{ to } 7V \text{ and } I_{load} = 50mA$$

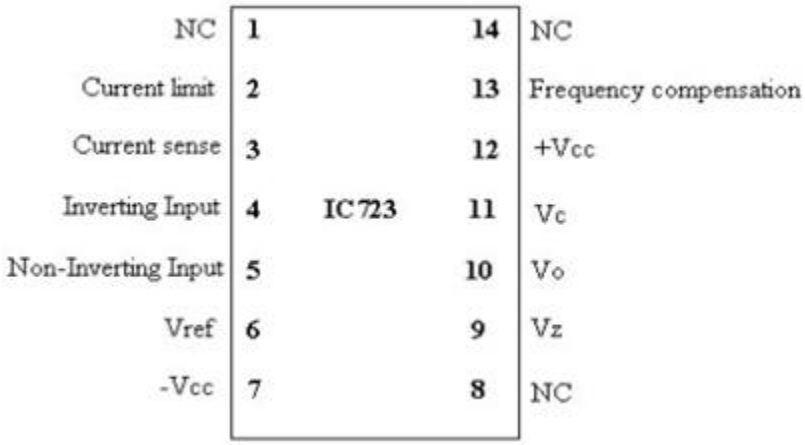

Figure 5.6.2.Pin diagram of IC723

[source: https://www.brainkart.com/subject/Linear-Integrated-Circuits_220/]

IC723 as a LOW voltage LOW current:

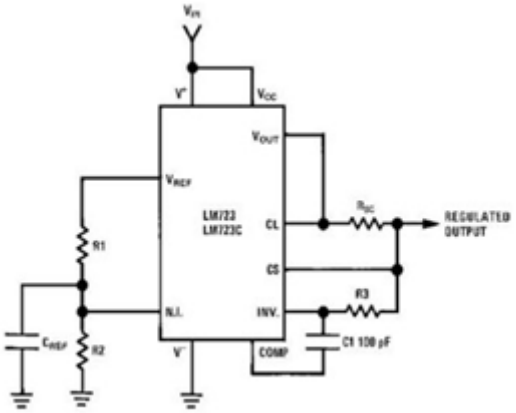

Figure 5.6.3.Typical circuit connection diagram

[source: https://www.brainkart.com/subject/Linear-Integrated-Circuits_220/]

- Circuit connection is shown in fig 3.R_1 & R_2 from a potential divider between V_{ref} & Gnd.
- The Voltage across R_2 is connected to the Non – inverting terminal of the regulator

$$I_C\ V_{non\text{-}inv} = R_2/(R_1+R_2)\ Vref$$

- Gain of the internal error amplifier is large

$$V_{non\text{-}inv} = V_{in}$$

- Therefore the Vo is connected to the Inverting terminal through R_3 & R_{SC} must also

be equal to $V_{non-inv}$

$$V_o = V_{non-inv} = R_2/(R_1+R_2)\ V_{ref}$$

R_1 & R_2 can be in the range of 1 KΩ to 10KΩ & value of R3 is given by

$$R_3 = R_1 ll\ R_2 = R_1R_2/(R_1+R_2)$$

Rsc (current sensing resistor) is connected between Cs & CL. The voltage drop across Rsc is proportional to the IL.

- This resistor supplies the output voltage in the range of 2 to 7 volts, but the load current can be higher than 150mA.
- The current sourcing capacity is increased by including a transistor Q in the circuit.
- The output voltage , Vo $= R_2/(R_1+R_2)\ V_{ref}$

IC723 as a HIGH voltage LOW Current:

- This circuit is capable of supplying a regulated output voltage between the ranges of 7 to 37 volts with a maximum load current of 150 mA.
- The Non – inverting terminal is now connected to V_{ref} through resistance R_3.
- The value of R_1 & R_2 is adjusted in order to get a voltage of Vref at the inverting terminal at the desired output.

$$V_{in} = V_{ref} = R_2/(R_1+R_2)V_0$$

$$V_o = [1+R_1/R_2]\ V_{in}$$

- Rsc is connected between CL & Cs terminals as before & it provides the shortCircuit current limiting Rsc =0.6/Ilimit
- The value of resistors R3 is given by ,

$$R_3 = R_1 ll\ R_2 = R_1R_2/(R_1+R_2)$$

IC723 as a HIGH voltage HIGH Current:

- An external transistor Q is added in the circuit for high voltage low current regulator to improve its current sourcing capacity. Circuit connection of IC 723 as a High voltage High current regulator is shown in figure 5.6.4. below

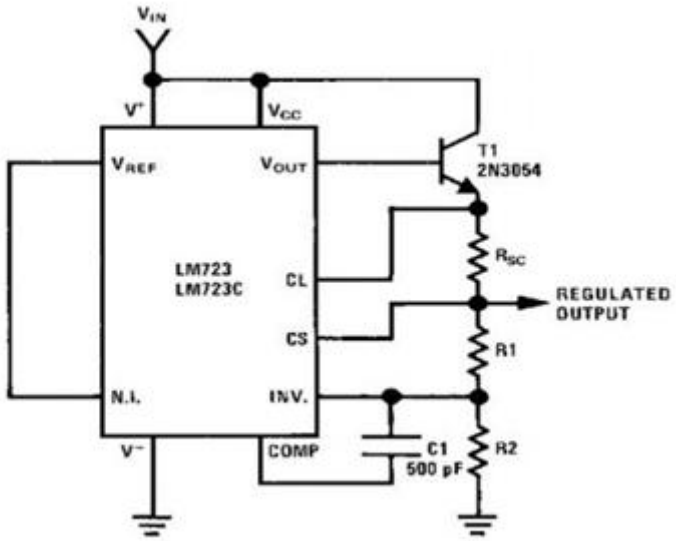

Figure 5.6.4.Circuit connection of IC 723 as a High voltage High current regulator

[source: https://www.brainkart.com/subject/Linear-Integrated-Circuits_220/]

- For this circuit the output voltage varies between 7 & 37V.
- Transistor Q increase the current sourcing capacity thus IL (MAX) is greater than 150mA.
- The output voltage Vo is given by ,

$$V_0 = Vo = [1+R_1/R_2]\ V_{in}$$

$$Rsc = 0.6/I\ limit$$