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# Over Current Protection in Power Supplies & Converters

Most AC-DC power supplies and DC-DC converters have internal current-limiting circuits to protect the power device, and to some degree its load. The majority of over-current-protections include an automatic recovery feature. In practice, the current limit feature typically starts operating when the output current excedes it maximum rating by 10 to 20%.

In many cases, should an overload (e.g., short circuit) be allowed to exist for a prolonged period, it can reduce the product's field life by temperature stressing the electrolytic capacitors, and in extreme cases, it can damage the user's printed circuit traces. Therefore, always check the power supply's "Instruction Manual" to be sure you understand the precautions associated with the power product's over-current-protection feature. Also, if the power product has an Output Good signal, this can be used as an indication that the power supply is either faulty or could be in an over-current mode.

There are a number of ways to implement over-current-protection (OCP), and below are descriptions of the most common methods.

Fold-Back Current Limiting: When this method is employed if an overload condition exists, the output voltage and current reduce to safe levels. As can be seen from the following curve, should an overload occur the supply will provide current up its current limit point (aka 'knee'), and then the output current will fold-back to a lower value as the output voltage reduces towards zero.

This technique is employed in linear power supplies because it reduces the strain on the supply's internal power devices to minimum. One drawback of fold-back current limiting is that if the supply turns on into a heavy capacitive load, it could latch-up at a reduced current before reaching its full output voltage. Depending upon the design, recovery from a fold-back current limit condition can be automatic, or after a built-in time delay when the overload condition is removed.
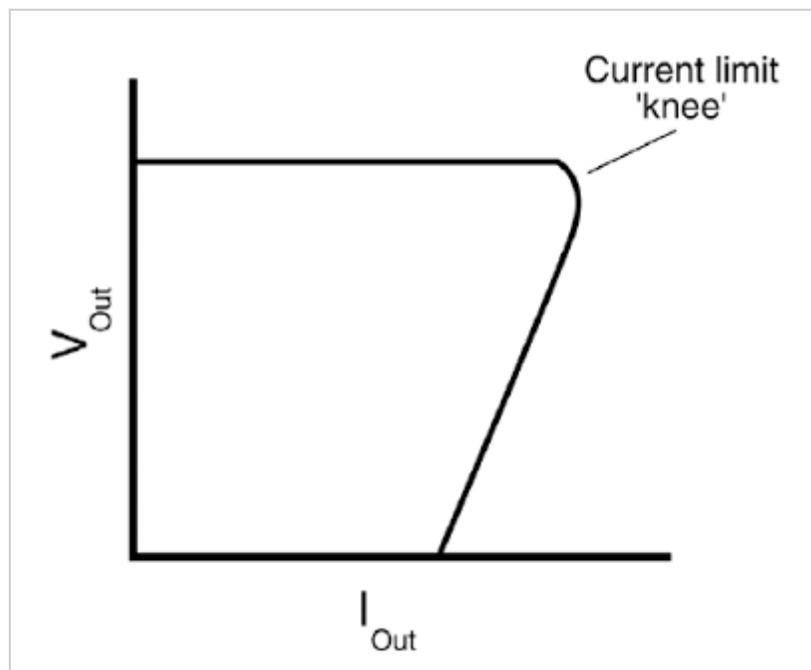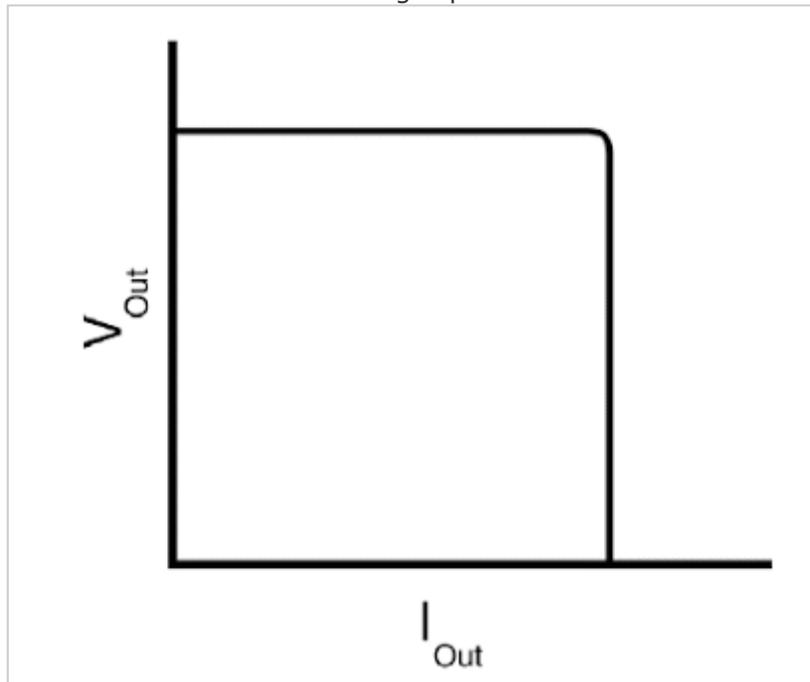

Fold-Back Current Limiting

Fold-Forward Current Limiting: In this method, when an overload is sensed the output voltage reduces towards zero, but the current increases. When driving motors, pumps, or highly capacitive loads, employing a fold-forward current feature can help overcome the electrical inertia of these loads. Recovery from a fold-forward current limiting situation is usually automatic when the overload is removed.
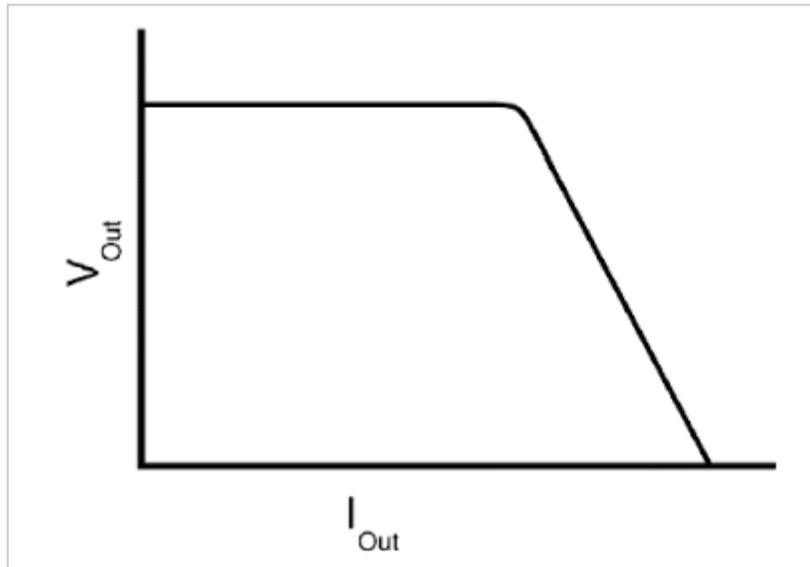
Fold-Forward Current Limit

Constant Current Limiting: In this method, should an overload occur, the output current stays at its limit point and the output voltage reduces towards zero in a somewhat linear fashion. This technique is used in many switchmode power supply designs. Typically, the supply will automatically return to its normal output voltage when the overload condition is no longer present.

Constant Current Limiting

Current Limit Shutdown: In some power supply designs, when an overload occurs the power supply will begin to go into a constant-current limit mode, but when the output reaches a preset reduced voltage, the supply will shutdown. Recovery from this condition can be automatic or require recycling of the input power.

Hiccup Mode Current Limiting: Some low power supplies have what is termed a hiccupcurrent-limit feature. As the name implies, if a current limit is sensed, the supply will reduce its output voltage to zero and then, after a short time, it will attempt to provide its normal voltage. These On-Off attempts at operation are referred to as a hiccup-mode. Should the overload condition be removed, the supply will again operate normally.

Peak-Current Power Supplies

It should be mentioned that some power supplies are designed specifically to provide large peak-currents, which can range from 200 to 300% of the maximum current rating for a short duration, without going into a current-limit condition. These are especially useful when powering loads that include electric motors such as computer hard drives, fans, actuators, pumps, etc. When using this type of power supply it is important to limit the "average power" that is delivered to load. More information about peak-current-rated supplies will be provided in a separate article.

Posted by Power Guy