

Protecting a power supply from regeneration

Application Note

AN90727

Power supplies are prone to failure if regeneration occurs at a voltage higher than the power supply can tolerate. A solution is to put in parallel to the power supply a rechargeable battery of higher voltage that absorbs the extra regeneration energy. The battery never conducts and mostly absorbs the recharging regeneration current so the battery can be of fairly small size. In essence the battery acts as a high voltage / high power zener diode.

A simple circuit will:

- Prevent that the regeneration voltage reaches the power supply (diode D1)
- Maintain a minimum voltage (V_s) across the battery (diode D3)

The regenerative voltage is clamped to $V_{zz} + D2$.

D2 is needed only if V_{bb} is too close to V_s so the clamping voltage needs to be slightly increased. As an alternative a string of a few diodes will behave like a zener diode of few volts.

Please note:

- This document also applies to LiPo batteries which have an internal protection circuit.
- D1 conducts continuously; must be rated for the max motors current.
- D1 prevents regenerative over-voltage reaching the power supply
- D2 conducts only during regeneration for a short period of time. It can be low power (about 5 watt).
- Experiment with regeneration. Ensure the max battery temperature is not exceeded.
- D3 purpose is to provide a recharging path to V_{zz} . R1 needs to be sized for a modest recharging trickle current. Both D3 and R1 can be low power (1 Watt).
- V_{zz} must be mechanically shielded in case of failure induced by excessive recharging current.

