Portable Electronics Input Power Protection
Application Overview

Problem/Solution

Portable electronics equipment, such as mobile phones or PDAs, is powered and/or recharged by AC/DC adapters that convert a line voltage or unregulated DC to a suitable low DC voltage for the equipment. With the growth in aftermarket adapters and universal chargers there is a growing risk of an unsuitable or faulty adapter being applied to the portable electronics equipment. The adapter applied voltage, polarity and permitted current may exceed the specifications of the power regulation circuits within the equipment, resulting in equipment damage and possibly even safety concerns.

A PolySwitch microSMD or nanoSMD device, in series with the power connector combined with a parallel voltage limiting device such as a Zener or transient suppression diode, helps provide effective protection against the use of nonapproved adapters.

Protection Requirements

Figure 1 illustrates the typical battery charging circuit in portable electronics equipment together with protection components. Unregulated DC power applied by the adapter is conditioned and converted to a suitable profile for charging the battery pack. In the case of a Li-ion pack, the final charging profile is constant current-constant voltage while NiMH packs require a constant current source. The coordinated action of the overvoltage and PolySwitch protection components is capable of:

- Protecting against reverse polarity where the diode will forward conduct and the PolySwitch device will trip and limit the current.
- Protecting against excessive applied voltage where the overvoltage device will break down and the PolySwitch device will trip and limit the current.
- Limiting excessive current draw as a result of an equipment or battery pack fault.

A PolySwitch device may also be used at the battery pack connector input where it helps provide additional equipment overcurrent protection from the application of faulty or inappropriate aftermarket packs. Accessory connector output power protection is also desirable if the equipment is required to supply limited power to an accessory such as a hands-free car kit or active headset.

Technology Comparison

A one-shot fuse is often considered for this application because of its small size. However, with the new generation of smaller microSMD and nanoSMD series, size is no longer a barrier to using resettable protection. The majority of faults experienced by the equipment are temporary in nature, and resettable protection would avoid costly warranty returns for isolated fault events.

Necked down traces combine the disadvantages of one-shot operation with poor tolerance fusing current.

Keyed adapter input plugs are often common but it is generally only a matter of days before aftermarket adapter manufacturers copy a keyed plug and present a quite different electrical interface to the product than originally intended, potentially with damaging consequences. Fortifying the downstream converter, for example by employing a higher breakdown regulating element, is generally more expensive and can lead to excessive power dissipation in the equipment.

Device Selection

Battery packs are typically charged at an initial 1C rate which, for packs of up to 1000mAH, corresponds to 1A current. Charging of NiMH packs can take place up to 60°C without significant degradation. Devices such as the microSMD075, microSMD150, nanoSMD100, or nanoSMD150 are typically used in these applications.

Table 1. Device Selection Table

Charging Current @60°C	Voltage Rating	Device
<0.5A	6 to 13.2V	microSMD075
		miniSMDC075
		nanoSMDC075
		miniSMDC075
0.5A to 1A	6 to 8V	miniSMDC110
		miniSMDC110
		microSMD110
		nanoSMDC100
>=1A	6 to 8V	miniSMDC150
		miniSMDC160
		nanoSMDC150

3

Figure 1. Typical Portable Electronics Charging Circuit with Protection