

OVER VOLTAGE PROTECTION ON AC ADAPTER INPUT

AN-31

User Information

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OVER VOLTAGE PROTECTION

High end PDAs and smart phones have a built in battery and most have a built in battery charger. When these appliances are purchased they usually come with a power supply to convert AC wall power to an input voltage suitable for the device, for example: +5V. If the internal power bus connects directly to the AC adapter power jack, the power supply is usually a self regulated type that stays within a range of $+5V \pm 10\%$ over both AC line changes and loading changes. Provided the end user always uses the proper adapter with the appliance, the power ICs can all be rated for 6V without a concern for the input voltage exceeding the voltage rating of the internal ICs. The concern is that occasionally an uninformed end user will get the adapters from two products mixed up and plug a loosely regulated linear power supply into an appliance that expects a tightly regulated input supply. If the appliance is lightly loaded, the voltage could be twice the rated voltage which could damage the unprotected ICs. This has caused a considerable amount of panic in the Handheld product development community causing some designers to insist on making all their power ICs be capable of withstanding 15V or more. This causes the appliance to be more expensive than necessary and less efficient, because higher voltage IC processes make IC die larger and more expensive than necessary for normal 5V operation. To think the appliance can be made capable of operating off any

type of power input is risky. Consider that some linear supplies have no filter capacitors (like those used with pulse chargers), so they have a raw rectified 50 to 60Hz sine wave that must be filtered. Also power plugs such as automobile power points have very high transient voltages and fusing currents and devices interfacing to these must be properly protected. All this adds to the cost of the handheld appliance.

The best way to approach this problem is to design the appliance for a well regulated AC adapter and make sure it can survive the application of the wrong input voltage. This is easy to do and can be done for a very low cost in a very small board area. The circuit below will open the P-channel MOSFET switch if a voltage greater than 6V is applied to the unit. The comparator and MOSFET are rated for 30V to handle a wide range of misapplied adapters. With this circuit, if the wrong voltage is applied, the appliance is isolated from the source. The FET driver is designed to turn the FET on slowly to minimize transients and off quickly to prevent circuit damage.

When the user realizes their appliance is not working and/or the battery is not charging, they will realize the adapter is not compatible with their handheld appliance. Once the proper adapter is plugged in, the appliance will function as designed with no harm done by attempting to use the wrong AC adapter.

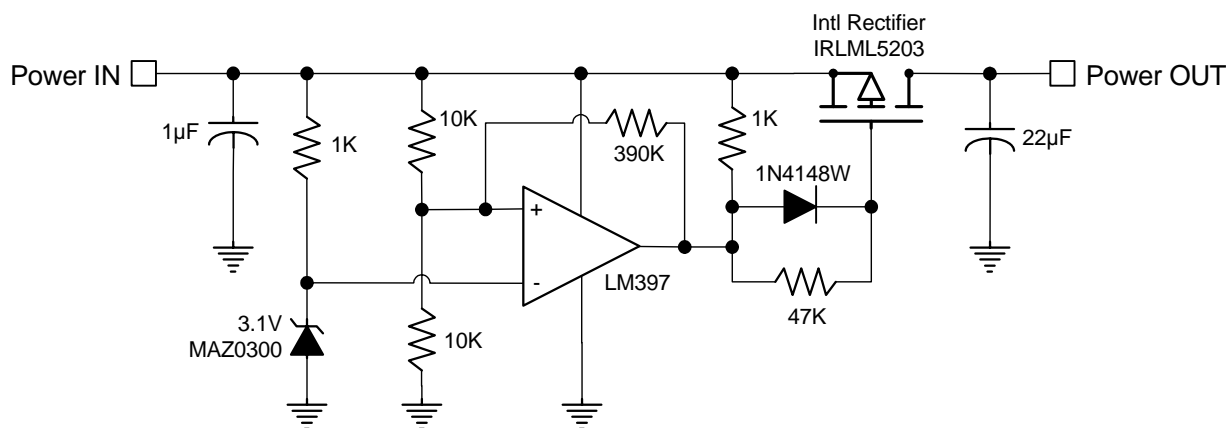


Figure 1