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APPLICATION NOTE 4219

Protection Circuitry for Reversed Charger Connections to the DS2784 High-Side nFET Protector

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Abstract: The DS2784 high-side nFET protector has no protection circuitry for reversed charger connections. Therefore, it is possible for the DC FET to stay on during a fault condition if the charger is connected in reverse polarity. This article explains the external circuitry that can be used so that the DC FET turns off in the event of a reversed charger connection.

The DS2784 has no circuitry that protects against reversed connection to a charger. In the event of a reversed charger connection, it is possible for the DC FET to stay on during a fault condition, thus completely depleting the battery. Due to current process limitations, thus far no internal solution to this problem exists. This article details the external circuitry that can be used to ensure that the DC FET turns off in the event of a reversed charger connection.

The DS2784 uses high-side, n-channel FETs (nFETs) to disconnect the battery during fault conditions. If a charger is connected in reverse polarity, the DS2784 sees -5V on PK+; this puts -5V on the source of the DC FET. When the protector attempts to turn off, it drives the gate to 0V. This leaves a +5V gate-to-source voltage on the DC FET, thus turning it on.

The solution to this problem is to use common-drain nFETs to short the DC FET's gate to the source in the event of a reversed charger connection. These FETs are configured to turn on when there is -5V PK+ to PK-; this essentially shorts the DC FET's gate to the source (**Figure 1**), thereby turning off the DC FET.
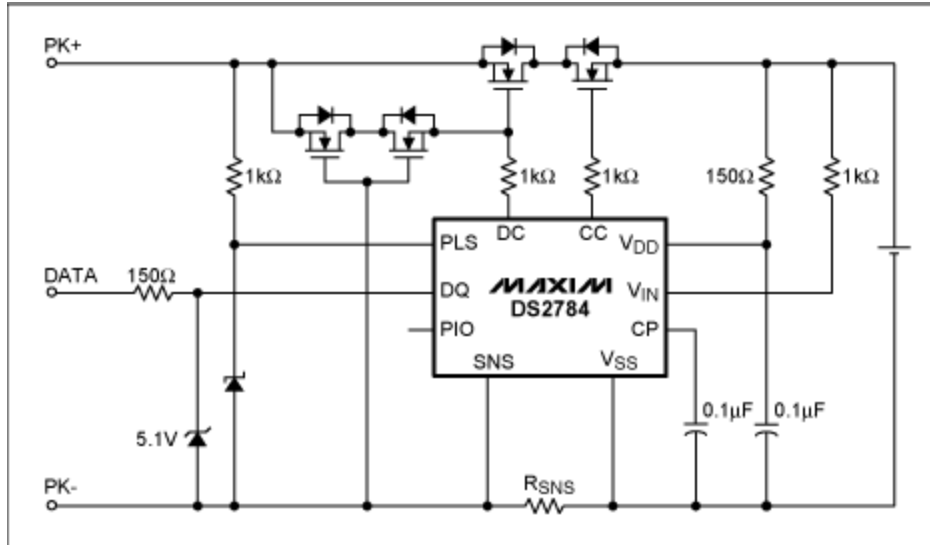
Figure 1. Common-drain nFETs short the DC FET's gate.

Common-drain nFETs must be used to allow the DS2784 to function properly during normal operating conditions. The DC pin has a weak driver, which has a worst-case current of 1µA. Any connection to the DC gate path must have minimal leakage or else it will collapse the charge pump, thus causing the protection FETs to turn off. Similarly, leakage in the PK+ path causes the IC to never recover from an overcurrent condition unless it is attached to a charger. The IC looks for PK+ to be pulled high to detect the removal of an overcurrent condition. This is achieved by a small current source on PLS, which has a worst-case current of 10µA.

Related Parts

DS2784	1-Cell Stand-Alone Fuel Gauge IC with Li+ Protector and SHA-1 Authentication	Free Samples

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