PTX30W Startup Circuit

This document describes how to prevent the PTX30W from supplying unregulated charging current into a deeply discharged battery during startup.

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1. Introduction

To prevent the PTX30W from supplying unregulated current into a deeply discharged battery, the battery has to remain disconnected from PTX30W until the biasing and bootup is complete. After this, the charger circuit operates as expected and provides a regulated current flow into the battery.

2. Charging Issue Description

When a battery is deeply discharged (VDBAT< 2.4V) the system gets stuck in a reset state with the internal charge regulation transistor conducting. If a RF field is present in that situation, the battery is charged with an undefined (unregulated) charging current. Although, trickle charge should be applied. This occurs for as long as the RF field is present. The effect is due to incorrect biasing of the pass transistor on VBAT when the system is not booted.

3. Charging Issue Solution

To mitigate this incorrect charger behavior, add a load switch in between the battery and the VDBAT pin (A1) of the PTX30W (see Circuit Diagram). This load switch can be a simple PMOS transistor or a more sophisticated integrated solution, depending on the application requirements.
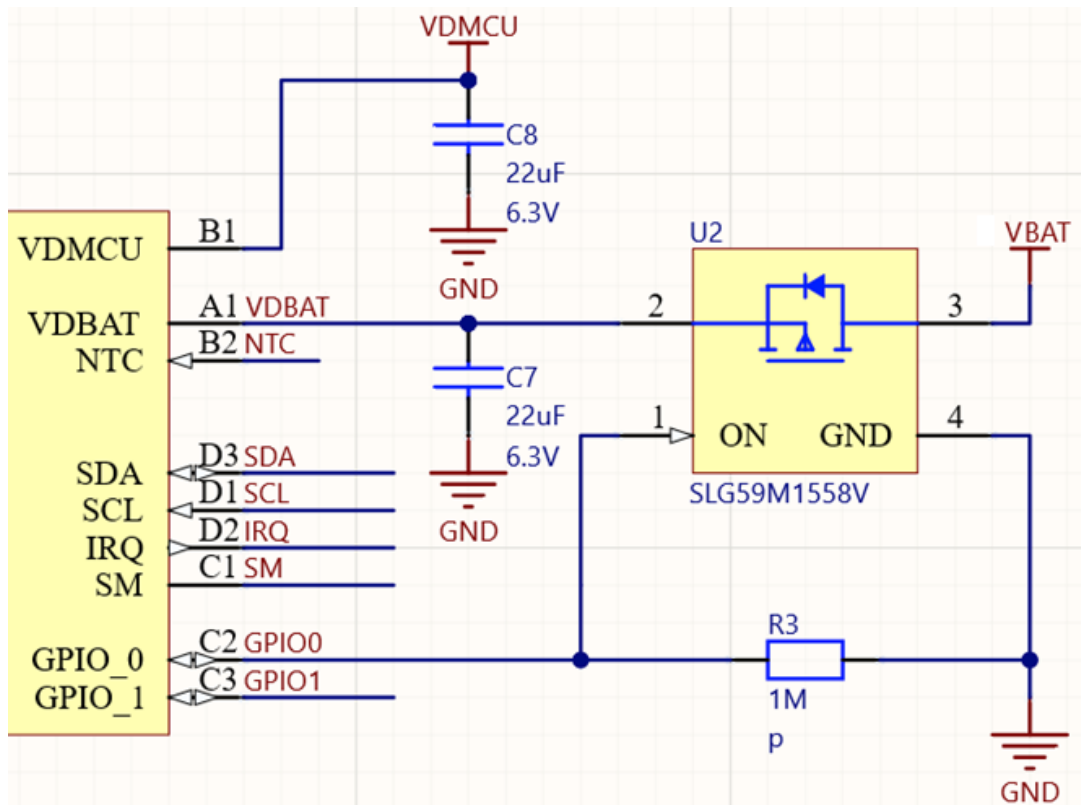
Once the PTX30W´s internal MCU has booted properly, it activates the load switch by driving the GPO0 pin high. The GPO0 pin requires a weak external pull-down resistor, typically 1MΩ.

This solution is supported by SDK version 2.2.0 and above.

4. Recommended Parts

- SLG59M1558V - GreenFET Single P-Channel Load Switch
- 1MΩ Pull-down Resistor

5. Circuit Diagram

The circuit depicted above will keep the battery disconnected as long as there is no voltage on GPIO0. The GPIO0 is set high by the microcode running in the PTX30W. This guarantees that bootup and biasing of the charge pass transistor are completed before the battery gets connected.

6. Operating Conditions

The added circuitry places the following limitations on operating conditions:

- **Startup via SM pin**
  - Startup via SM pin is only possible if the PTX30W is supplied with a VDBAT > = 3V. There is a voltage drop of VBAT on the body diode of the load switch while the system is in shipping mode. Therefore, the forward voltage drop of that diode must be added to the minimum voltage level required on pin VDBAT (A1) for the circuit to start. Using the SLG59M1558V load switch, the VBAT is required to be at least 3.4V to start.

- **Current draw from VDDC**
  - Since the battery is completely disconnected from the PTX30W in shipping mode, the initial power delivered at the beginning of the charging cycle (defined by the Polling Power Level setting and the coil arrangement) has to be more than the current demand of the circuitry connected to VDDC.

    This can be tested by setting the initial, minimum and maximum power level the same as the Polling Power Level and observing the charge current without a load at VDDC. This observed charge current is the upper limit of current draw allowed on VDDC.

7. Revision History

Revision	Date	Description
1.00	Mar 21, 2024	Initial release.

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