LT3652 MPPT Charger Design Calculations for MicroSun Project

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1. Project Overview

This document outlines the design calculations for configuring the LT3652-based MPPT solar battery charger, targeting a 12V SLA battery and a 15W solar panel.

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2. Charging Current Sense Resistor (R_SENSE)

Objective: Limit charging current to 1.5A maximum.

Formula:

R_SENSE = 0.1 / I_CHG(MAX)

Calculation:

R_SENSE = 0.1 / 1.5 = 0.0667 ohms

Recommended: Use standard value **0.068 ohm**, 1% tolerance, ≥0.5W rated, low TCR.

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3. How These Feedback Resistor Values Were Chosen (with LM234)

From the datasheet (Figure 9b), they used this design procedure:

Given:

- TC (temperature coefficient) = −19.8 mV/°C
- V_FLOAT (25°C) = 13.8 V
- R_SET = 2.4 kΩ for LM234

Step 1: Compute R_FB1

R_FB1 = −R_SET × (TC × 4405)
= −2.4k × (−0.0198 × 4405)
= 2.4k × 87.219 ≈ 209.3 kΩ

Designers approximated this to **210 kΩ** or even **309 kΩ** for tuning.

Step 2: Compute R_FB2

R_FB2 = R_FB1 / ((V_FLOAT + R_FB1 × (0.0674 / R_SET)) / V_FB − 1)

Where:

- V_FB = 3.3V (LT3652 internal reference)
- V_FLOAT = 13.8V (target float voltage)
- R_SET = 2.4kΩ
- R_FB1 = 309kΩ

Step 3: Adjust R_FB3 to make R_FB2 || R_FB3 ≈ 63.5 kΩ That matches the required divider to bring the VFB node to 3.3 V at the proper V_FLOAT.

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4. VIN_REG Divider for MPPT (Input Voltage Regulation)

Objective: Hold solar panel input at ~17.6V (Vmp) for maximum power point tracking.

Formula:

R1/R2 = (V_IN / 2.7) - 1

Target V_IN: 17.6V

Calculation:

R1/R2 = (17.6 / 2.7) - 1 ≈ 5.52
Assume R2 = 100kΩ → R1 ≈ 552kΩ

Standard Value Selection:

- R1 = 549 kΩ
- R2 = 100 kΩ

Verification:

V_VIN_REG = 17.6 * 100 / (549 + 100) ≈ 2.71V ✅

This satisfies the LT3652 requirement to regulate at 2.7V.

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5. Summary of Key Design Values

Parameter	Value
Max Charge Current	1.5 A
R_SENSE	0.068 Ω
Feedback Resistors	309k, 174k, 100k
VIN_REG Divider	549k, 100k
