

Application Brief 42019

Calculating Frequency Setting Resistors when Using the ML4835

INTRODUCTION

This Application Brief describes a procedure that can be used to calculate the value of resistors used to set preheating, starting, and full power operating frequencies. In this example the inverter frequencies used for preheating, starting and full power are 64.5kHz, 50kHz and 40kHz, respectively.

SOLVE FOR R_T

R_T is the resistor that sets the minimum or full power operating frequency.

The following values are taken from the ML4835 Data Sheet:

V_{REF} of 7.5V and I_{DIS} of 5.5mA (Electrical Characteristics, page 4); and V_{TH} of 3.75V and V_{TL} of 1.25V (Figure 9, page 9).

To calculate R_T a value for C_T must first be chosen. A value of 1.5nF for C_T produces a reasonable discharge or dead time (see Electrical Characteristics, page 4) and keeps $I_{CHG} < 0$ after the preheating time interval (see note 1 in Figure 9 on page 9).

$$t_{DIS} = \frac{(V_{TH} - V_{TL})C_T}{I_{DIS}} = 0.68\mu s$$

R_T can then be solved. For the case where $f_{OSC} = 2$ times the inverter frequency, or 80kHz:

$$R_T = \frac{\frac{1}{f_{OSC}} - t_{DIS}}{0.544C_T} = 14.5k\Omega.$$

SOLVE FOR R_{SET}

R_{SET} is the resistor that sets the preheating frequency.

To simplify the solution for I_{CHG} let $V_1 = V_{REF} - V_{TL}$ and let $V_2 = V_{REF} - V_{TH}$. Then substitute into and reconfigure equation 4 from page 10

$$I_{CHG} = \frac{V_1 - V_2 \left(e^{\frac{t_{CHG}}{R_T C_T}} \right)}{R_T \left(e^{\frac{t_{CHG}}{R_T C_T}} - 1 \right)}$$

From equation 3 on page 10

$$t_{CHG} = \frac{1}{f_{OSC}} - t_{DIS} = 7\mu s$$

Then $I_{CHG} = 190\mu A$.

From equation 6 on page 10

$$I_{CHG} = \frac{2.5}{R_{SET}}, \text{ so } R_{SET} = 13.1k\Omega$$

This value of R_{SET} satisfies the requirement of note 1 in figure 9 on page 9.

SOLVE FOR R_{T2}

The parallel equivalent resistance of R_T and R_{T2} determines the starting frequency.

From equation 5a on page 10

$$R_T \parallel R_{T2} = \frac{1}{0.544 \times f_{OSC} \times C_T} = 12.25k\Omega$$

So $R_{T2} = 79.1k\Omega$.

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