



APPLICATION NOTE 3889

Using the DS2746 to Identify a Battery-Pack Based on an Identification Resistor

Abstract: The DS2746 has two auxiliary inputs to allow voltage sampling of resistor divider circuits; these inputs are ideal for measuring thermistor or battery-pack identification resistors. This application note describes how to calculate the resistance (in ohms) of the unknown resistor in order to properly identify a battery pack based on an identification resistor.

Calculating Unknown Resistance

The V_{OUT} pin drives a resistive divider formed by a known resistor and an unknown resistance that is to be measured. The device reports the unknown resistance as a ratio of the total resistance of the divider network. Making these measurements ratiometric with respect to V_{OUT} removes reference tolerance from the error calculations.

The datasheet for the [DS2746](#) describes the format of the Auxiliary Input Registers in terms of $1 \text{ LSB} = V_{VOUT} * 1/2047$. The lower 4 bits of the Auxiliary Input Registers are not defined; consequently, the register needs to be shifted 4 bits to the right. To get $AUXIN_{Ratio}$, multiply the register by the LSB value (1/2047):

$$AUXIN_{Ratio} = \frac{\text{Register} \gg 4}{2047} \quad \text{Eq. 1}$$

$AUXIN_{Ratio}$ is the ratio of the Auxiliary Input Resistance to the total resistance of the resistive divider (the sum of the known resistor and the Auxiliary Input Resistor):

$$AUXIN_{Ratio} = \frac{AUXIN_{Resistance}}{\text{Known Resistor} + AUXIN_{Resistance}} \quad \text{Eq. 2}$$

Solving Equation 2 for $AUXIN_{Resistance}$ gives the following equation:

$$AUXIN_{Resistance} = \frac{\text{Known Resistor} * AUXIN_{Ratio}}{1 - AUXIN_{Ratio}} \quad \text{Eq. 3}$$

Generating an Example

A DS2746K Evaluation Kit Board can be used to generate an example. The DS2746K uses 10kΩ resistors as the known resistor value for both auxiliary inputs. The more precise the value of the known resistor, the more precise the measured $AUXIN_{Ratio}$ value will be. If, for example, the known resistor on a sample DS2746K board is measured to be 10,250Ω, that value, rather than the assumed 10,000Ω, should be used to calculate the unknown resistance.

If the resistor is connected between Auxiliary Input 0 and ground, Auxiliary Input 0 Register reports 2840h. Accordingly, $AUXIN_{Ratio}$ is calculated (with Equation 1) to be:

$$AUXIN_{Ratio} = \frac{2840h \gg 4}{2047} = 31.46\%$$

Equation 3, therefore, provides the following value when solved for $AUXIN_{Resistance}$:

$$AUXIN_{Resistance} = \frac{10,250\Omega * 0.3146}{1 - 0.3146} = 4704.92\Omega$$

Conclusion

The auxiliary inputs of the DS2746 are useful for measuring thermistors or identification resistors located inside the battery pack. The DS2746 reports the measured resistance as a ratio of a resistive divider. That ratio can easily be calculated into the resistor value in terms of ohms so that a battery pack's identification resistor can be compared to the expected value.

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