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## CC2541: Battery Service



[sadasivam arumu...](#) *Intellectual 940 points*  
Community Member

Part Number: [CC2541](#)

Other Parts Discussed in Thread: [CC2540](#)

Hi,

Please find the below snippet:

/\*\*

\* Battery level conversion from ADC to a percentage:

\*

\* The maximum ADC value for the battery voltage level is 511 for a

\* 10-bit conversion. The ADC value is references vs. 1.25v and

\* this maximum value corresponds to a voltage of 3.75v.

\*

\* For a coin cell battery 3.0v = 100%. The minimum operating

\* voltage of the CC2540 is 2.0v so 2.0v = 0%.

\*

\* To convert a voltage to an ADC value use:

\*

\*  $(v/3)/1.25 * 511 = \text{adc}$

\*

\* 3.0v = 409 ADC

\* 2.0v = 273 ADC


\*

\* We need to map ADC values from 409-273 to 100%-0%.

\*

\* Normalize the ADC values to zero:

\*

 409 - 273 = 136

\*  
\* And convert ADC range to percentage range:  
\*  
\*  $\text{percent}/\text{adc} = 100/136 = 25/34$   
\*  
\* Resulting in the final equation, with round:  
\*  
\*  $\text{percent} = ((\text{adc} - 273) * 25) + 33 / 34$   
\*  $\text{percent} = ((\text{adc} - \text{battery\_min}) * \text{Numerator} + (\text{denominator} - 1) / \text{denominator}$   
\*/

Can you explain on this ADC conversion equation and percentage equation?

[over 5 years ago](#)



**Clément** *over 5 years ago*

[TI\\_Guru\\*\\*](#) 101430 points

Hi,

The battery voltage can be between 3V (100% loaded - ADC measures 409) and 2.0V (0% loaded - ADC measures 273). Then we calculate in order to convert an ADC value varying between 273 and 409 to a percentage (between 0 and 100).

*sadasivam arumugam said:*

$(v/3)/1.25 * 511 = \text{adc}$

=> This comes from the ADC: as mentioned, the reference value is three times smaller than the actual value. In addition the value returned at full scale by the ADC is 511.

*sadasivam arumugam said:*

$\text{percent} = ((\text{adc} - \text{battery\_min}) * \text{Numerator} + (\text{denominator} - 1) / \text{denominator}$

=> this is a way to force an integer division to round the result (instead of truncate it).

I hope this will help,

Regards,



[sadasivam arumugam](#) *over 5 years ago in reply to Clément*

[Intellectual](#) 940 points

Yes, This helps me.

And if we use external reference voltage as 3.32 then how will the ADC equation changes



[Clément](#) *over 5 years ago in reply to sadasivam arumugam*

[TI\\_Guru\\*\\*](#) 101430 points

Hi,

You have to adapt the code with the characteristics of your own project. I cannot do this for you as I do not have all the characteristics of your project.

If you change the reference voltage, I assume you are changing also the maximum and minimum battery voltage, the maximum value measured by the ADC, and so on and so forth.

Regards,



[sadasivam arumugam](#) *over 5 years ago in reply to Clément*

Yes. I am changing the voltage max and min as per reference voltage.

[Intellectual](#) 940 points

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