

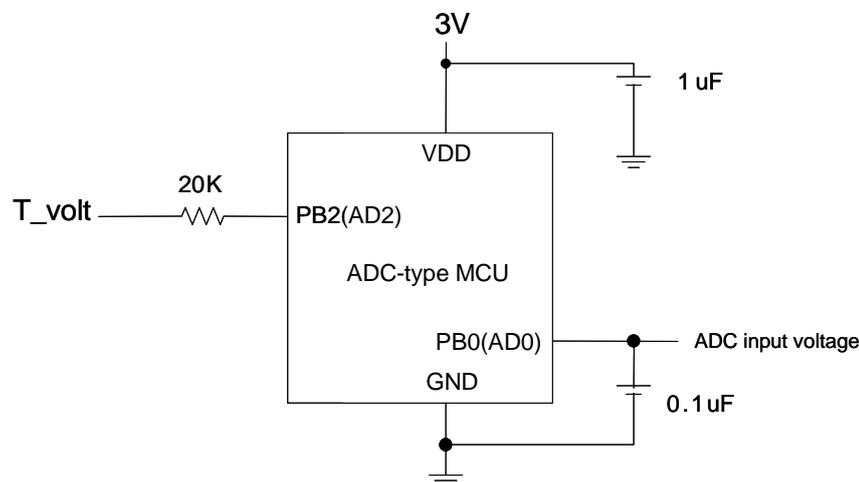
### Effects of over voltage input to the ADC

#### Application Note

Applied for: All MCU that includes ADC

In some applications, through connecting a resistor to an IO of a MCU, the positive over voltage (higher than VDD voltage) or negative over voltage (lower than GND voltage) can be detected. In case the connected IO is one of the “shared” pins that can be configured as a normal IO and an ADC input channel, (e.g. PB0 (AD0) pin), the over voltage input to this pin will hereby disturb the conversion results on other ADC channels.

As shown as below figure, both PB0(AD0) and PB2(AD2) are the IO pins that can be configured as an ADC input channel. T\_volt is an external high voltage which can be connected to PB2 through the 20k ohms resistor. PB2 is now configured as IO input mode and only used for detecting T\_volt level whereas PB0(AD0) is configured as an ADC channel.



The current will inject to PB2 when the voltage of T\_volt is exceed the maximum input range (lower than -0.3V or higher than VDD+0.3V) and this injection current will disturb the conversion result on PB0(AD0) even if it is lower than the allowable limit of maximum injected current ( $I_{INJ}$ ). Normally, the higher is the injected current to PB2, the much is the impact against the PB0 conversion. The positive over voltage for PB2 may result in a too-high reading whereas the negative over voltage may result in a too-low reading of PB0 AD conversion.

The following figures of PB0 are collected from the practical situation when VDD=3V (for reference only),

When T\_volt =4V, the injected current  $\cong 50\mu\text{A}$ , the ADC reading will be about 10% too high.

When T\_volt =5V, the injected current  $\cong 100\mu\text{A}$ , the ADC reading will be about 25% too high.

To prevent the above situation, please connect the over voltage source (T\_volt) to an “pure” IO pin which is only possible to be configure as a normal IO (e.g. PA2) instead of the “shared” pins which can be configure as a normal IO or AD channel {e.g. as above PB2(AD2)}. For PMC or P series MCU that includes ADC (e.g. PMC271 or P232C), please avoid using PB0 ~ PB7 (AD0 ~ 7), PA3 and PA4. For PDK series, please avoid using PB0 ~ PB7. For MCU that does not include ADC, there is no limitation.

If you have any questions on the application, please contact our agent at your nearest location or contact us at [fae@padauk.com.tw](mailto:fae@padauk.com.tw).