ADC Offset calibration

Due to variations inherent characteristics of the circuit configuration and manufacturing process, cause ADC Internal comparator circuit generates different degrees of offset error. So the offset voltage to compensate for the high-precision generated ADC Conversion architecture is critical. LGT8FX8P Inside the chip ADC Test interfaces support offset voltage, offset measurement and can be completed in coordination with the calibration software.

Offset calibration principle:

Offset calibration mainly by changing the internal comparator input polarity, tested positive and negative directions ADC Conversion results. Since both directions offset voltage is expressed as two polarities, by converting these two subtraction result, the offset error can be obtained an intermediate. When a normal application, the conversion result can be adjusted according to this offset voltage.

Offset calibration process:

1. Configuration VDS Module, VDS Analog power input source selection (AVCC)
2. ADC Reference voltage selection analog supply (AVCC)
3. ADCSRC [SPN] = 0, ADC Read 4 / 5VDO Channel, the conversion value is recorded as PVAL
4. ADCSRC [SPN] = 1, ADC Read 4 / 5VDO Channel, the value of the recording bit conversion NVAL
5. The value (NVAL - PVAL) >> 1 Storage to OFR0 register
6. ADCSRC [SPN] = 1, ADC Read 1 / 5VDO Channel, the conversion result is recorded as NVAL
7. ADCSRC [SPN] = 0, ADC Read 1 / 5VDO Channel, recording bit conversion result PVAL
8. The value (NVAL - PVAL) >> 1 Storage to OFR1 register
9. Set up ADCSRC [OFEN] = 1 Enable offset compensation function

Special Note: Because the offset error of plus or minus direction, The above data are signed and an arithmetic operation.

Offset calibration process needs to be changed ADC Configuration, it is recommended that offset calibration is complete before configuring normal use. In order to improve calibration accuracy, it is recommended ADC Repeatedly sampling the filtered read channel conversion.

Offset calibration OFR0 / 1 After the configuration, by OFEN Bit enables automatic offset compensation. After normal after conversion, ADC Control will be based ADC Conversion result, automatically OFR0 / 1 To compensate.

ADC Dynamic Calibration

Offset calibration method described above, based on the test environment and a test input offset. When the system environment changes, ADC The imbalance will also change. Therefore, if real-time calibration can be compensated for with the working device against the environmental changes caused by differences in performance, improved ADC Measurement accuracy is very important.

There is provided a recommendation algorithm to be used, based on the principle offset calibration algorithm can be implemented to bring dynamic work environment to compensate offset errors, consistent and accurate test results.

This method does not calculate the offset voltage, it does not enable offset compensation (OFEN) . Algorithm only need SPN control ADC Conversion polarity different SPN Downsampling two measurements, two offset errors result due to the introduction of the performance of both positive and negative directions, so we can easily cancel the offset error produced by the method of the addition averaging.

We assume that when the ADC During the conversion, the offset errors introduced into the test as VOFS Therefore control SPN Conducted twice ADC Conversion, the resulting ADC Conversion result can be expressed as:

SPN = 1 Time, $V_{ADC1} = V_{REL} + V_{OFS1}$

SPN = 0 Time, $V_{ADC0} = V_{REL} - V_{OFS0}$

We will be adding the two measurements, can be eliminated V_{OFS} The actual sampling input V_{REL} Impact of. Because the matching characteristics of the circuit, V_{OFS1} with V_{OFS0} It may not be exactly the same, but the overall effect is still compensate for offset errors can be achieved.

Dynamic offset compensation algorithm process:

1. Depending on the application initialization required ADC Conversion parameters