

Simple-VFD Product

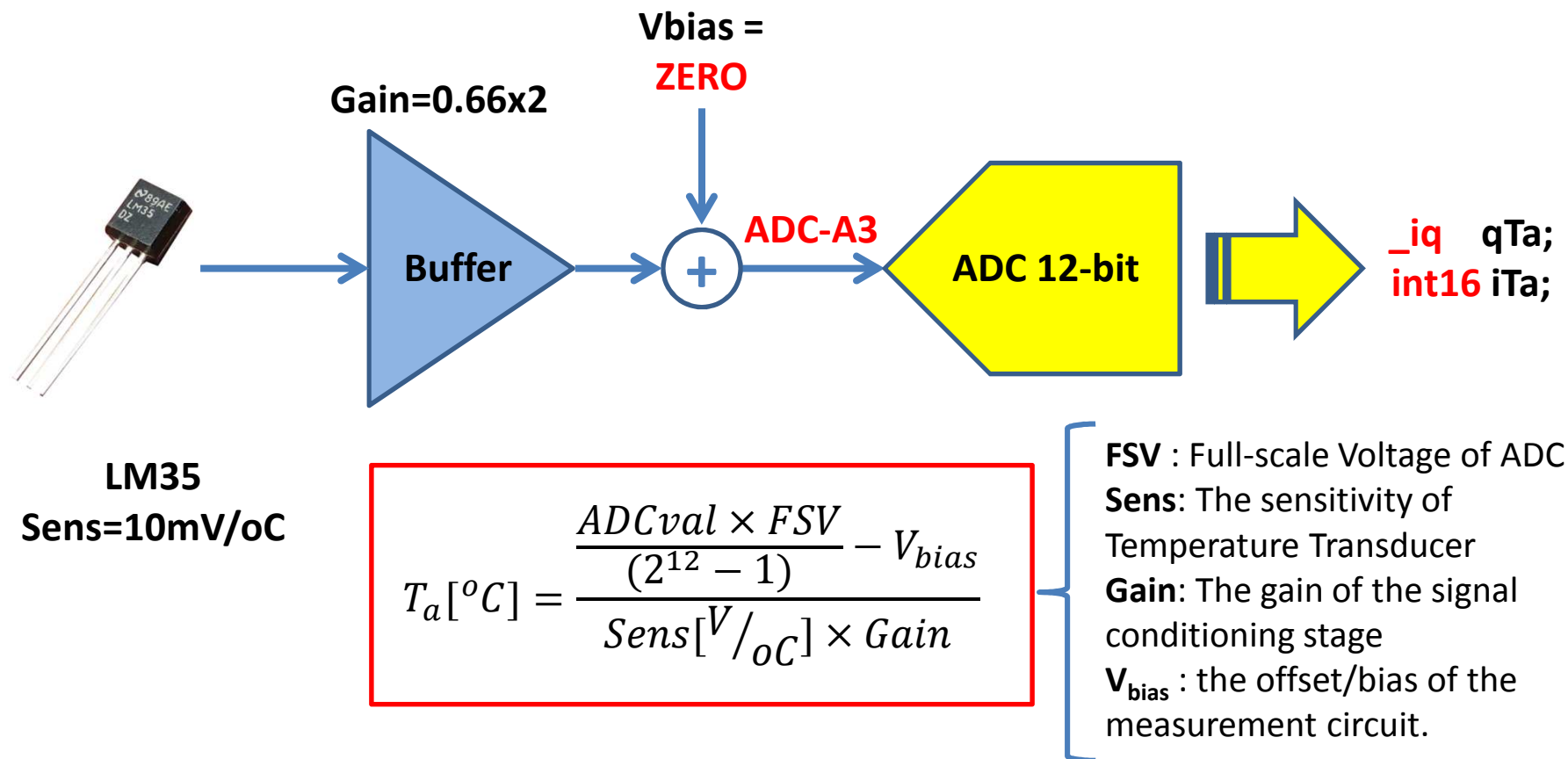
Part Of Signal Condition

By: Tran Binh Duong

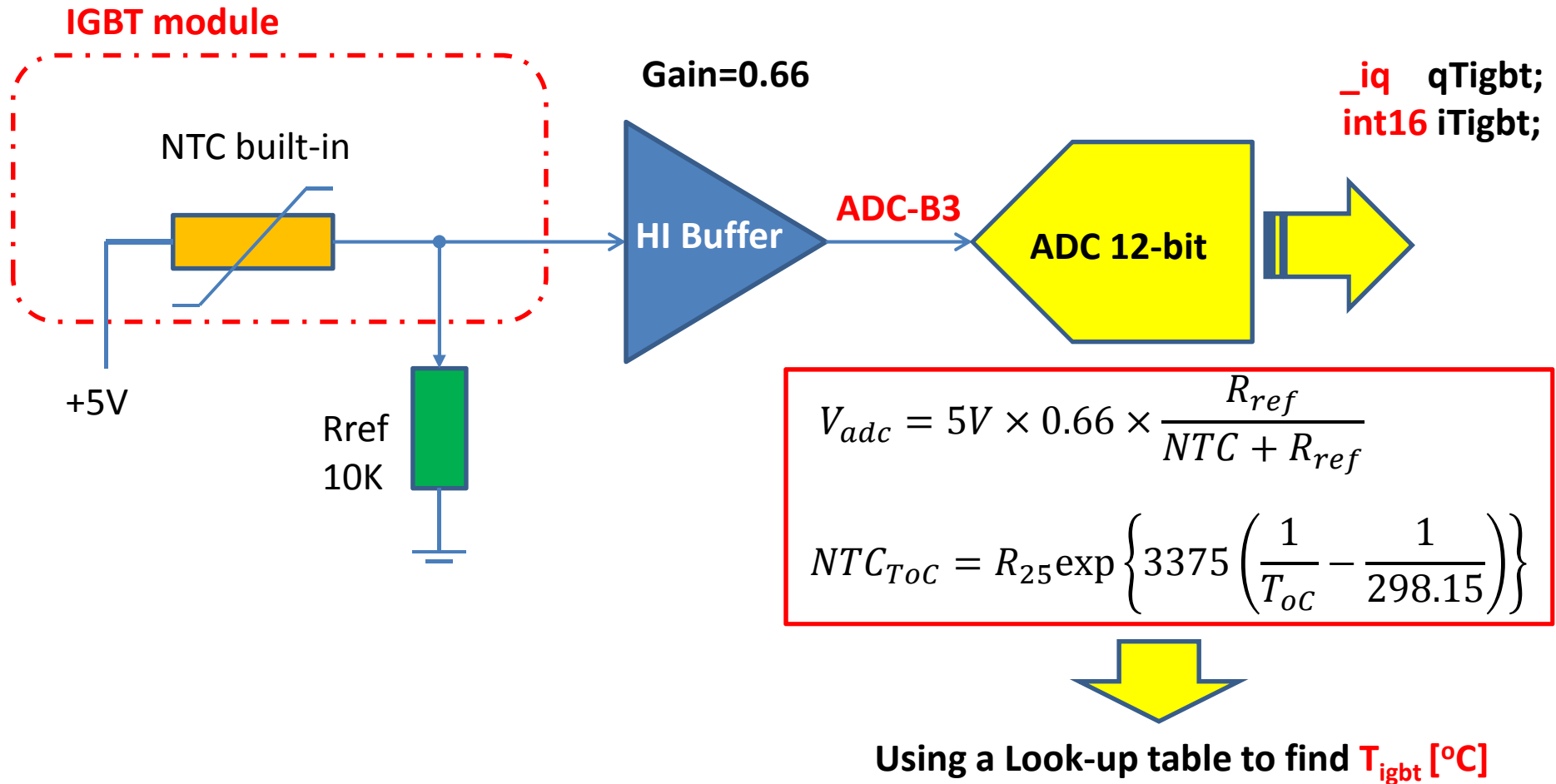
Title: Chief Eng. and Project Manager

Last updated: 28-Jan-2016

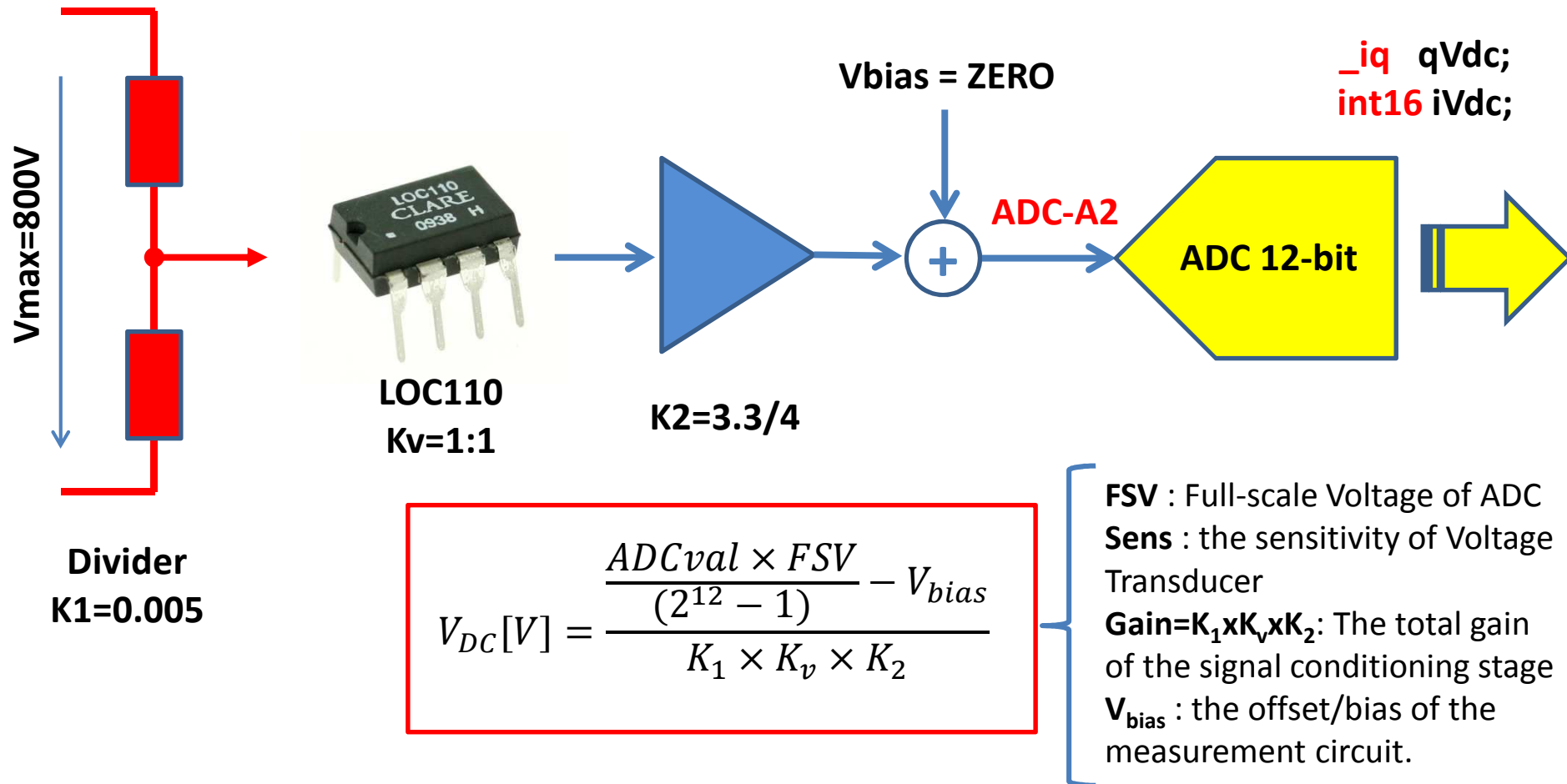
1. Ambient Temperature Channel



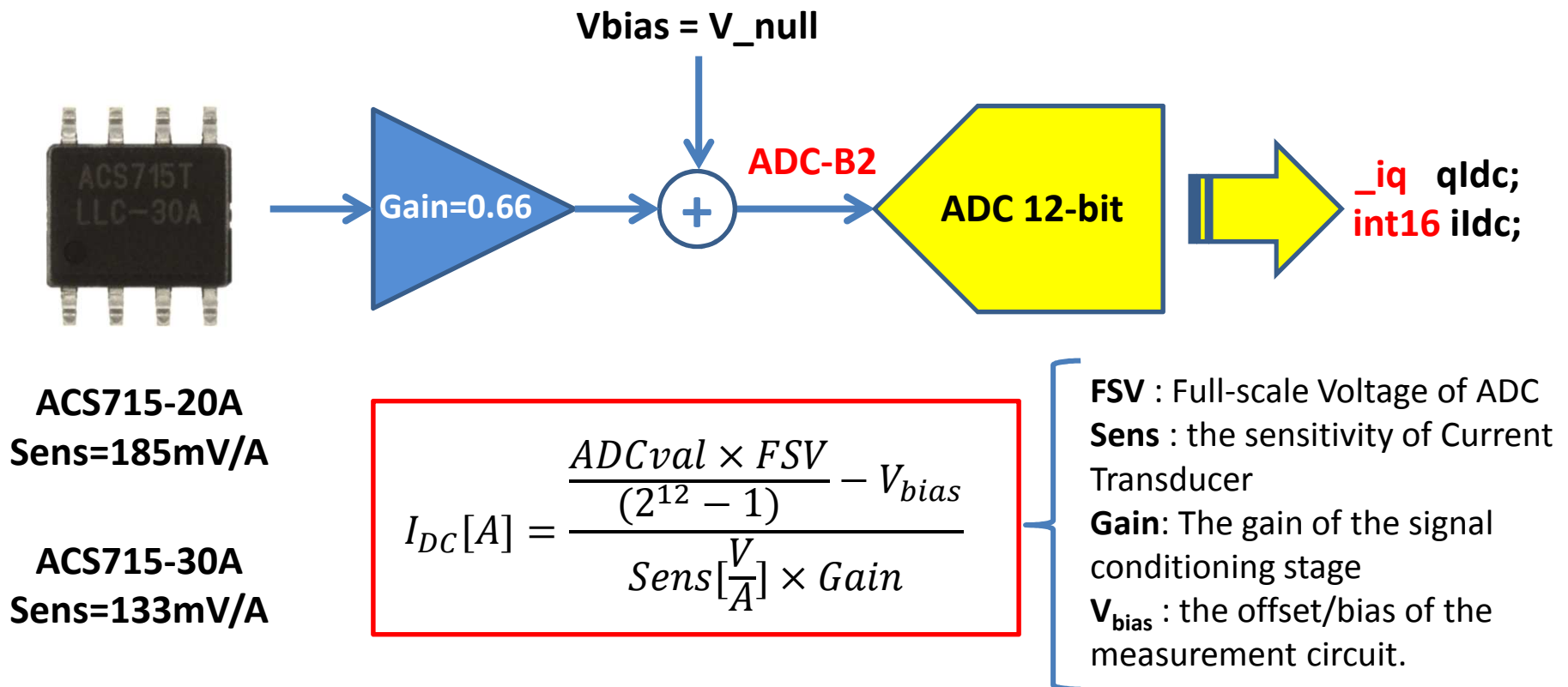
2. IGBT-module's Temperature Channel



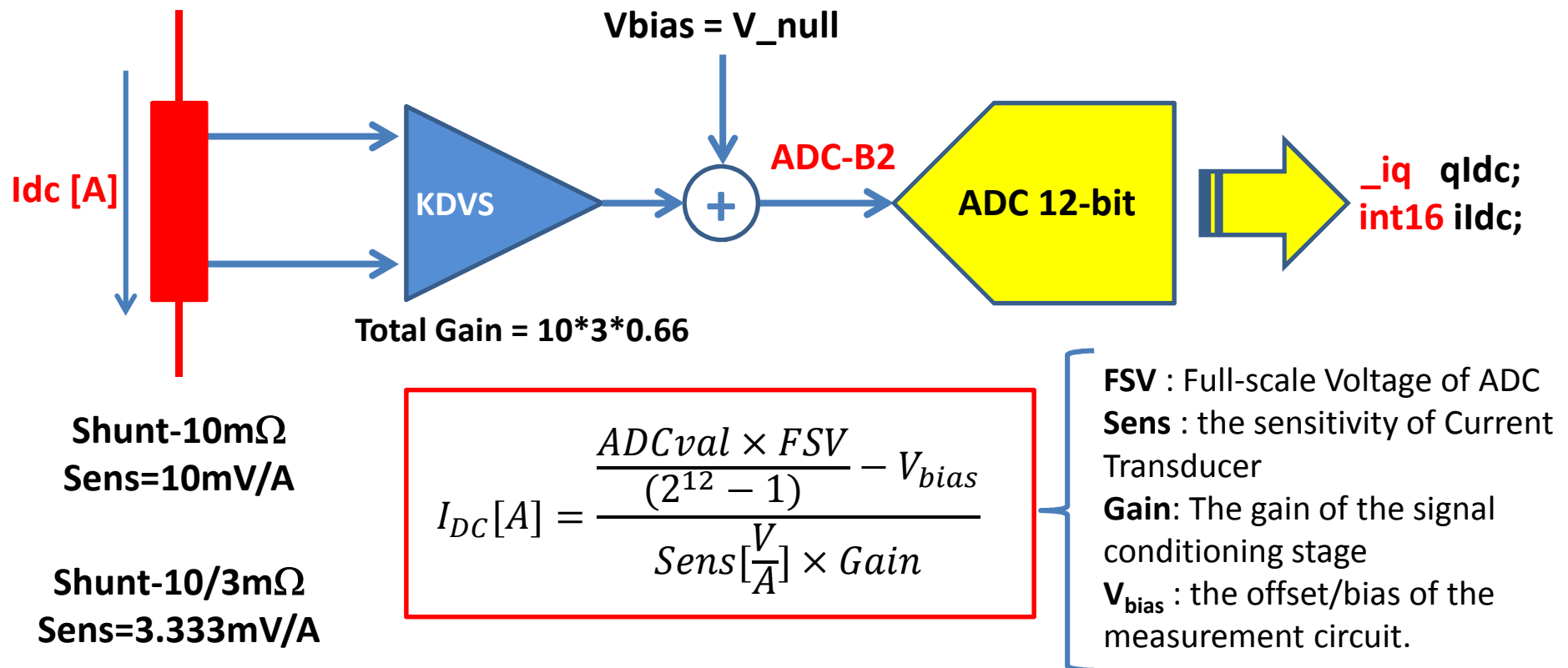
3. DC-Link Voltage Channel



4.1. DC-Link Current Channel (ACS715)

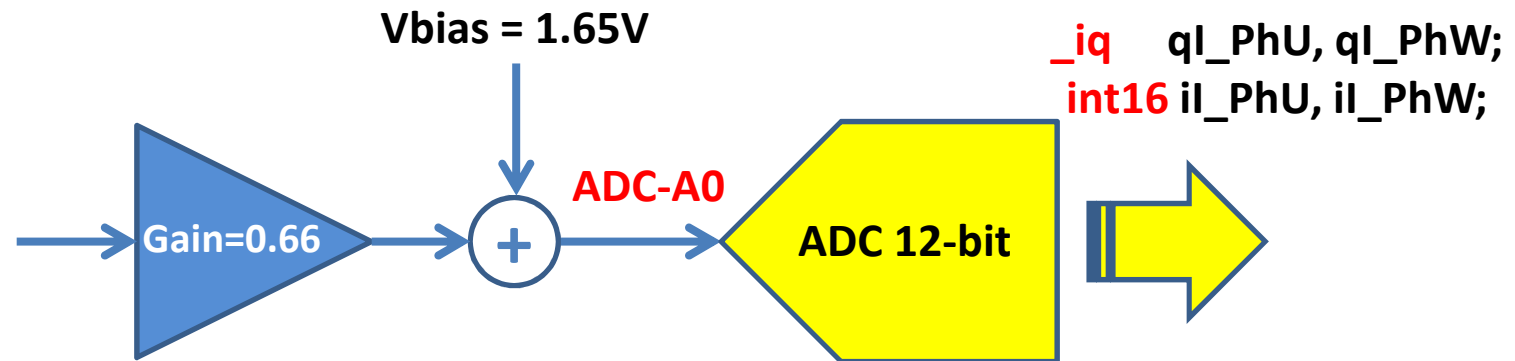


4.2. DC-Link Current Channel (Shunt)



5.1 Motor Current Channels (ACS)

ACS712-30A
Sens=66mV/A
x2 channels



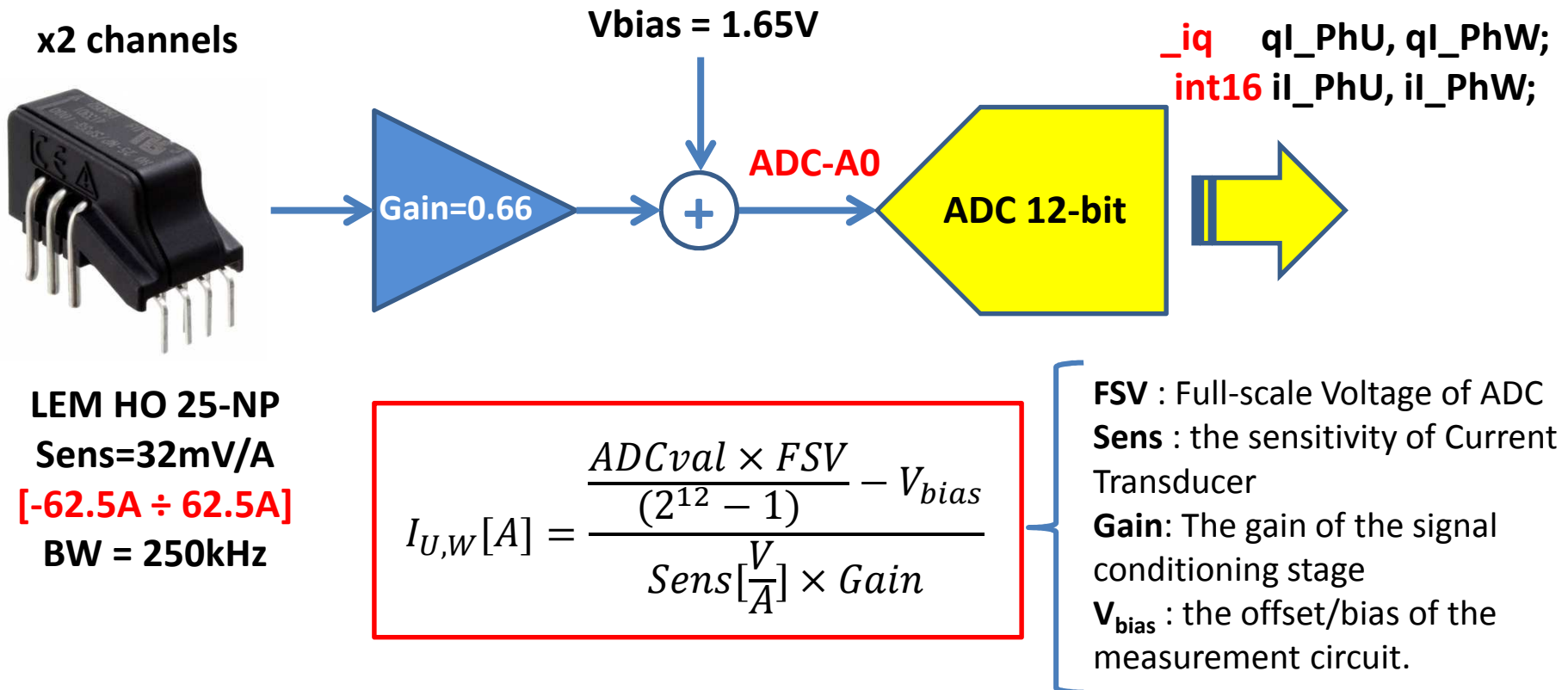
ACS712-20A
Sens=100mV/A
 $I_{PM} = [-20A; +20A]$
BW = 80kHz

ACS756-50A
Sens=40mV/A
 $I_{PM} = [-50A; +50A]$

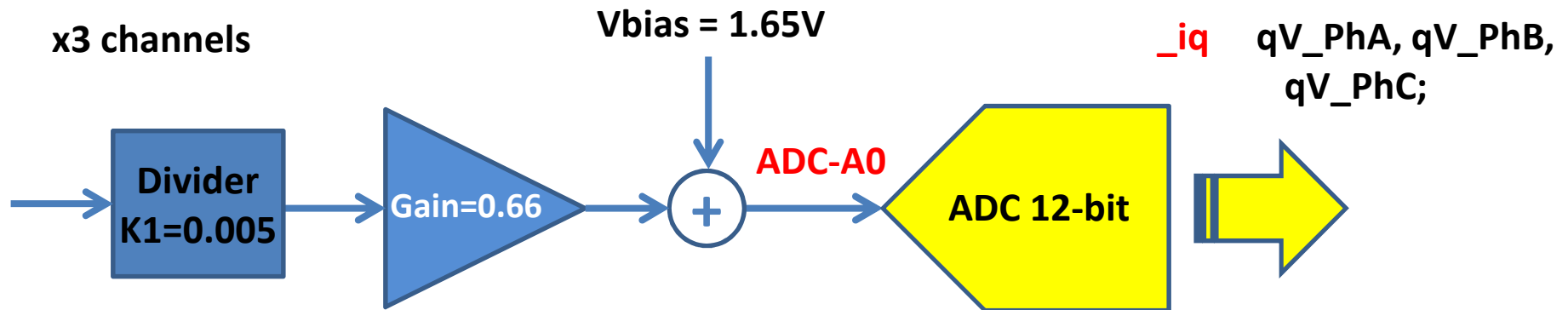
$$I_{U,W}[A] = \frac{\frac{ADCval \times FSV}{(2^{12} - 1)} - V_{bias}}{Sens[\frac{V}{A}] \times Gain}$$

FSV : Full-scale Voltage of ADC
Sens : the sensitivity of Current Transducer
Gain: The gain of the signal conditioning stage
V_{bias} : the offset/bias of the measurement circuit.

5.2 Motor Current Channels (LEM)



6. Motor Phase Voltage Channels



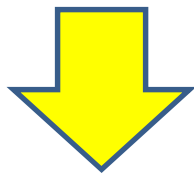
$$V_{a,b,c}[A] = \frac{\frac{ADCval \times FSV}{(2^{12} - 1)} - V_{bias}}{Sens\left[\frac{V}{V}\right] \times Gain}$$

FSV : Full-scale Voltage of ADC
Sens : the sensitivity of Current Transducer
Gain: The gain of the signal conditioning stage
V_{bias} : the offset/bias of the measurement circuit.

7.1 How to implement with IQmath (a)

- The general equation:

$$Q_{E.U} = \frac{\frac{ADCval \times FSV}{(2^n - 1)} - V_{bias}}{Sens \left[\frac{V}{E.U} \right] \times K}$$



Representing in Global IQ-format:

- **E.U** : The engineering unit of the sensing parameter or quantity.
- **FSV** : Full-scale voltage of ADC
- **n**: The number of bits of the built-in ADC
- **Sens**: The sensitivity of the used transducer
- **K**: The gain of the signal conditioning stage (SCS).
- **V_{bias}** : the bias or offset of the SCS **when having no the sensing quantity.**

❑ **Variables:**

- qEU
- qVbias

❑ **Constants:**

- CONS_IQ_FSV
- CONS_IQ_GAIN
- CONS_IQ_SENS

7.2 How to implement with IQmath (b)

- For ADC-12bit and Global IQ = 24:

Declaration

```
//Constants
#define CONS_IQ_FSV      _IQ(3.3)
#define CONS_IQ_GAIN    _IQ(1/K)
#define CONS_IQ_SENS    _IQ(1/Sens)
#define CONS_IQ_COFF    _IQ(1/(K*Sens))

//Global variables
_iq qEU, qVbias;
```

Implementation

```
//Assuming that the quantity is monitored by
//the ADC-A0. So, at the initialization of the
//system.
qVbias = _IQmpy(CONS_IQ_FSV,
_IQ12toIQ((_iq)AdcResult.ADCRESULT0);

//At running state of the system
qEU = _IQmpy(CONS_IQ_FSV,
_IQ12toIQ((_iq)AdcResult.ADCRESULT0) -
qVbias;

//Converting to the real value in Q-format.
qEU = _IQmpy(CONS_IQ_COFF, qEU);
```

Thanks for the attention!

Contact to: Eng. Tran Binh Duong

Title: Project Manager and Hardware Engineer.

Email: tran.binhduong@gmail.com

THE END.