Title	***InnoSwitch™3-Pro Programming Manual***
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Introduction

InnoSwitch3-Pro is a highly integrated digitally controllable offline CV/CC flyback switcher IC.

Together with a Microcontroller, InnoSwitch3-Pro can be used to design digitally controllable power supply solutions such as USB PD power adapters, and custom programmable industrial power supplies.

A code library and API is available for download from the InnoSwitch3-Pro product page (www.power.com) using the link below:
https://ac-dc.power.com/products/innoswitch-family/innoswitch3-pro/

This document describes the basic operation of the I^2C interface, command sequences for operations and use of functions that have been provided in the code library.

PATENT INFORMATION

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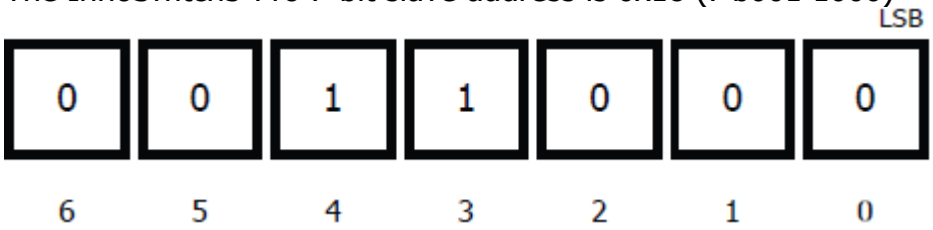
1 Introduction

This manual describes the software implementation including driver libraries used to control InnoSwitch3-Pro operations. Important aspects of this document are calculations for the values to be programmed for various configurations such as voltage, current, cable drop compensation, constant power, I^2C command sequences to prevent any unexpected behaviors, device responses and code Examples.

2 InnoSwitch3-Pro I^2C Communication

2.1 *InnoSwitch3-Pro Slave Address*

The InnoSwitch3-Pro 7-bit slave address is 0x18 (7'b001 1000)



In the below 2 sections, the following conventions will be used

[A] denotes a Slave Acknowledgement
[a] denotes a Master Acknowledgement
[na] denotes a Master nack
[W] denotes Write (1'b0)
[r] denotes Read (1'b1)
[PI_COMMAND] PI COMMAND Register Address Assignments, Table 2 in Datasheet
[TELEMETRY_REGISTER_ADDRESS] Telemetry (Read-Back) Registers Address Assignment and Description, Table 3 in Datasheet

2.2 *InnoSwitch3-Pro Write Operation*

The I^2C write operation format is as follows:

[PI_SLAVE_ADDRESS][W][A][PI_COMMAND][A][Byte][A]

for one byte of data to be written

or

[PI_SLAVE_ADDRESS][W][A][PI_COMMAND][A][Low Byte][A][High Byte][A]

for one word of data to be written

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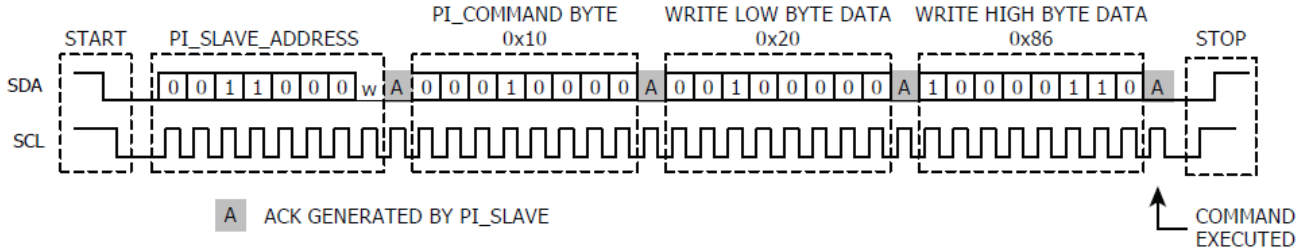
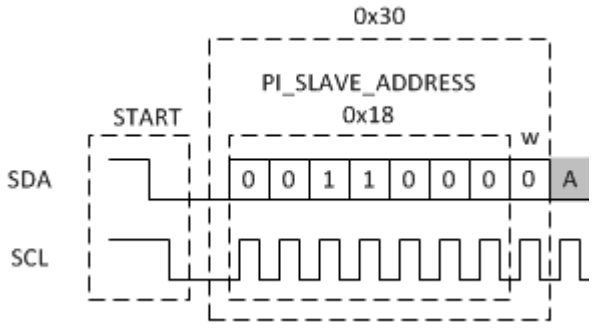


The PI_SLAVE ADDRESS which originally is 0x18 (7'b001 1000) is left shifted by 1 bit to occupy the 7 high bits from the MSB of the first byte sent through the I^2C communication. The LSB of this byte is for commanding R/W (read/write) operation. Writing '0' to this bit is for writing a data to any of the PI_COMMAND in the slave and writing a '1' to this bit is for reading a data from any of the TELEMETRY_REGISTER. So for a write operation, the PI_SLAVE_ADDRESS combined with the '0' at the LSB for indicating write operation gives 0x30 as the first byte sent over I^2C communication as shown below.



2.3 *InnoSwitch3-Pro Read Operation*

The I^2C read operation format is as follows:

[PI_SLAVE_ADDRESS][W][A][READ REGISTER][A]
[TELEMETRY_REGISTER_ADDRESS][A][TELEMETRY_REGISTER_ADDRESS][A]

[PI_SLAVE_ADDRESS][r][A]{PI Slave responds Low Byte}[a]{PI Slave responds High Byte}[na]

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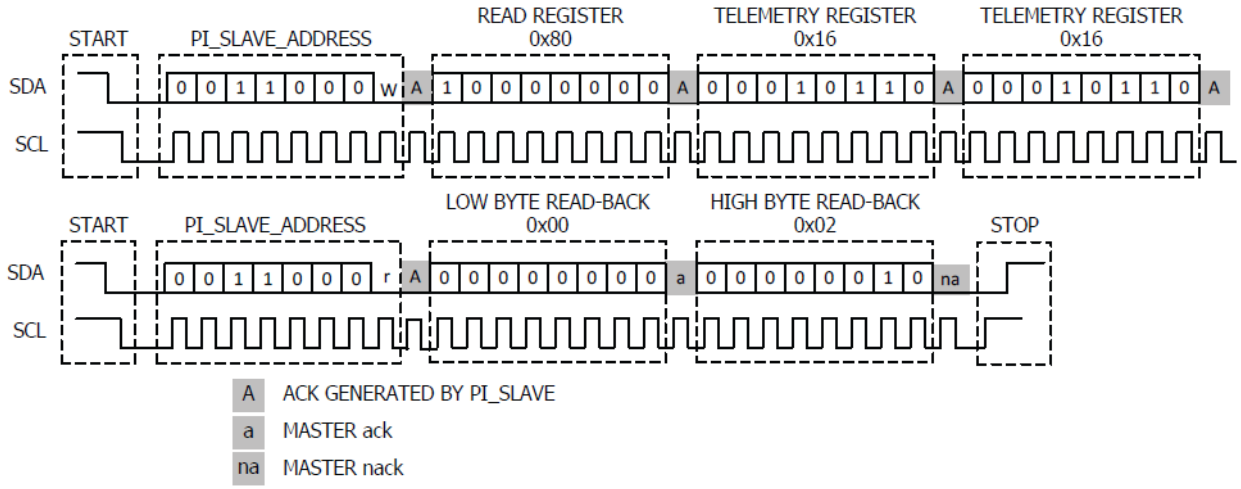
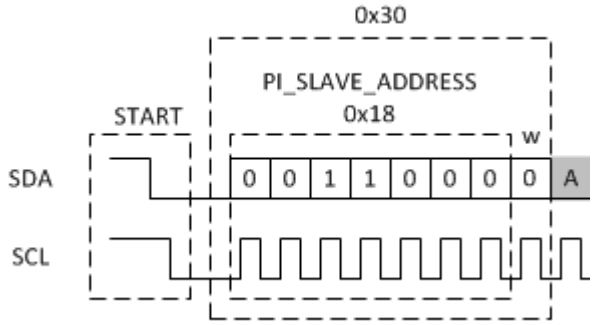
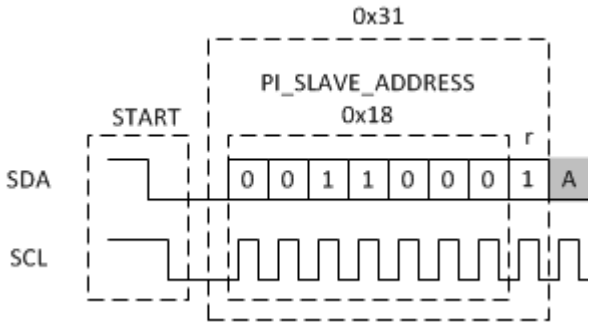


The address of the telemetry register from which data needs to be read, is first written to the Read Register which acts like a pointer to this telemetry register. The address of the Read Register is 0x80. Since the first operation while reading is a write operation, the first byte of the I^2C transaction is as follows



Then in the next I^2C operation, a read request is sent to the slave and as a response to this request, the slave sends the Low Byte followed by the High Byte stored at the respective Telemetry register whose address was written to the Read Register. The first byte during this read operation of the I^2C transaction is as follows



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3 Constant Voltage Setting Calculations

Output voltage setting values are calculated based on its specific resolution (e.g. 10mV/LSB). High and low limits for this parameter in the code are recommended to ensure the device operation is within the correct range.

Output Voltage Calculation:

Register	Adjustment Range	Resolution
CV	3 V to 24 V	10 mV / LSB

Equation:

$$LSB\ Representation = \frac{Set\ Point\ in\ Volts}{Resolution}$$

Example: 'x' volts to be converted in decimal representation.

$$LSB\ Representation = \frac{x}{\frac{10mV}{LSB}} = \frac{x}{\frac{10}{1000}V}LSB$$

$$LSB\ Representation = x * 100$$

This can be converted to equivalent hexadecimal value and odd parity must be added.

3.1 *Code Example*

```
float Inno3Pro_Compute_CV( float fSetPt)
{
        float fTemp = 0;
        fTemp = (float)(fSetPt * INNO3PRO_CV_SET_PT_MULT);
        sig_minmax(fTemp,300,2400); //Set Limits
        return fTemp;
}
```

Macro:

```
#define INNO3PRO_CV_SET_PT_MULT (float)(100)
#define sig_minmax(sig,min,max)((sig<min)?sig=min:(sig >max)?sig=max:0)
```

The saturation macro sets the lower and upper ends for the range. Since maximum limit is set to 2400, values greater than this maximum limit are clamped to 2400. Likewise, values less than the minimum limit are clamped to 300.

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4 Constant Current Setting Calculations

Constant current (CC) regulation set point is calculated as a percentage of the full scale CC threshold set by the sense resistor between the IS and GND pins. It can be programmed from 20% to 100%.

The $I_{SV(TH)}$ parameter value (with a typical value of ~32 mV) is considered as the full scale CC regulation voltage threshold. This is treated as 100% for CC setpoint which in decimal representation is programmed as 128 (Lower 7 bits of the byte are used for CC setpoint programming). If a 10 mΩ sense resistor is used then 3.2 A will be considered as the full scale CC setpoint. If a CC setpoint value <3.2 A needs to be programmed, then first it has to be calculated as a percentage of the full scale CC setpoint and then the percentage value needs to be converted to its equivalent decimal representation as shown below.

Equation:

$$Percentage\ = CC\ Set\ Point\ in\ Amps\ *\ Sense\ Resistor\ in\ m\Omega\ *\ \frac{100}{Isv_{(Th)}\ in\ mV}$$

$$Decimal\ Equivalent\ = Percentage\ *\ \frac{128}{100}$$

Example:
Rsense = 10 mΩ
CC setpoint = 1.6 A

$$Percentage\ = 1.6A\ *\ 10\ m\Omega\ *\ \frac{100}{32\ mV}$$

$$Percentage\ = 50\ \%$$

$$Decimal\ Equivalent\ = 50\ *\ \frac{128}{100} = 64$$

This can be converted to equivalent hexadecimal value and odd parity must be added.

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4.1 *Code Example*

```
 float Inno3Pro_Compute_CC ( float fSetPt)
{
        float fTemp = 0;
        fTemp = (float)(fSetPt * INNO3PRO_CC_SET_PT_MULT);
        sig_minmax(fTemp,25,128); //Set Limits
        return fTemp;
}
```

Macro:

```
#define INNO3PRO_RSENSE (float)(5)
#define INNO3PRO_FULL_RANGE_RSENSE_VOLTAGE (float)(32)
#define INNO3PRO_ADC_FULL_RANGE (float)(128)
```

Formula: CC Set Point Computation: (Value * Rsense * 128 / 32)

```
#define INNO3PRO_CC_SET_PT_MULT (float)((INNO3PRO_ADC_FULL_RANGE * INNO3PRO_RSENSE) /
INNO3PRO_FULL_RANGE_RSENSE_VOLTAGE)
```

Similar to the CC setting, a minimum (25) and maximum (128) limit for the CC setpoint is recommended to be used in the program.

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5 Constant Power Knee Voltage Setting Calculations

Similar to writing the Constant voltage setting, since the resolution of the constant power knee voltage setting (V_{KP}) is 100 mV, the V_{KP} setpoint needs to get multiplied by 10 to convert to the equivalent decimal value to be written. It can be programmed from 5.3 V to 24 V.

Equation:

$$LSB\ Representation = \frac{Set\ Point\ in\ Volts}{Resolution}$$

Example: 'x' volts to be converted in decimal representation.

$$LSB\ Representation = \frac{x}{\frac{100mV}{LSB}} = \frac{x}{\frac{100}{1000}V}LSB$$

$$LSB\ Representation = x * 10$$

This can be converted to equivalent hexadecimal value and odd parity must be added.

5.1 *Code Example*

```
float Inno3Pro_Compute_VKP( float fSetPt)
{
        float fTemp = 0;
        fTemp = (float)(fSetPt * INNO3PRO_VKP_SET_PT_MULT);
        sig_minmax(fTemp,53,240); //Set Limits
        return fTemp;
}
```

Macro:

```
#define INNO3PRO_VKP_SET_PT_MULT (float)(10)
```

Similar to the CV setting, a minimum (53) and maximum (240) limit for the V_{KP} setpoint is recommended to be used in the program.

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6 Cable Drop Compensation Setting Calculations

Cable drop compensation (CDC) can be programmed from 0 to 600 mV in 50 mV increments. 600 mV corresponds to a decimal equivalent of 12 and 0 corresponds to a decimal equivalent of 0.

Equation:

$$LSB\ Representation = \frac{Set\ Point\ in\ Volts}{Resolution}$$

Example: 'x' volts to be converted in decimal representation.

$$LSB\ Representation = \frac{x}{\frac{50mV}{LSB}} = \frac{x}{\frac{50}{1000}V}LSB$$

$$LSB\ Representation = x * 50$$

This can be converted to equivalent hexadecimal value for programming.

6.1 *Code Example*

```
float Inno3Pro_Compute_CDC( float fSetPt)
{
        float fTemp = 0;
        fTemp = (float)(fSetPt / INNO3PRO_CDC_SET_PT_DIV);
        sig_minmax(fTemp,0,12); //Set Limits
        return fTemp;
}
```

Macro:

```
#define INNO3PRO_CDC_SET_PT_DIV (float)(50)
```

Similar to the CV setting, a minimum and maximum limit for the CDC setpoint is recommended to be used in the program.

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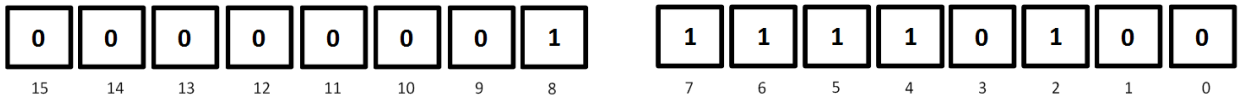
7 Parity Bit Implementation

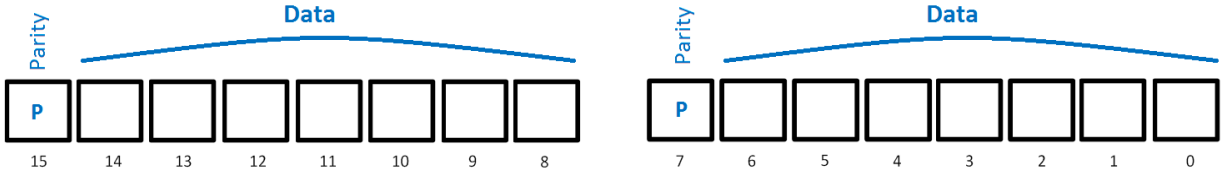
Some registers have simple error detection mechanism using odd parity checking. In odd parity bit error checking, the total number of 1s in the binary format of the value (including the parity bit) must be an odd number. Selective registers contain parity bit on each of the Low and High Bytes. Details of all the registers are in the data sheet.
Example:

Register	Output Voltage	LSB Representation	Hex without Parity	Hex with Odd Parity
CV	5 V	500	0x01F4	0x83F4

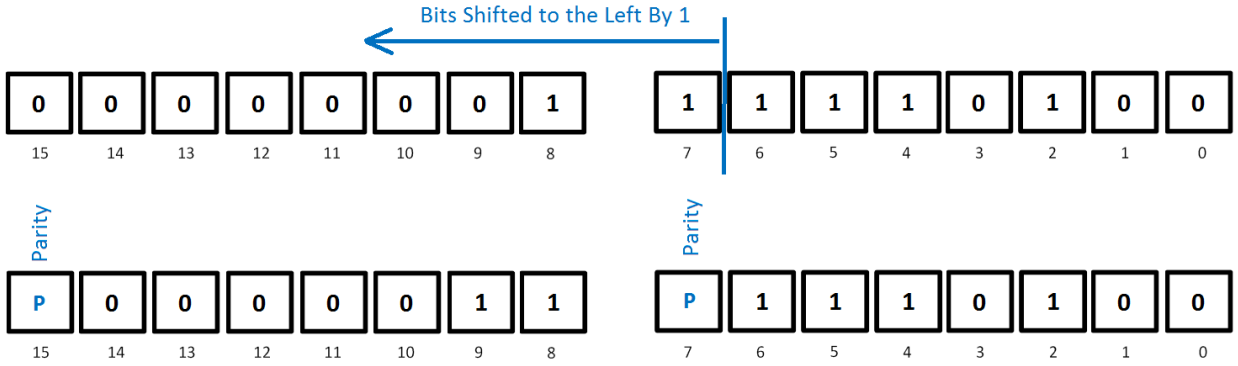
Simple Binary Conversion:



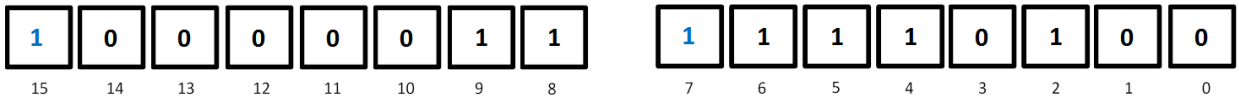
Some registers require Bit 7 and Bit 15 to be used for odd parity bit implementation; these bits must not contain the converted binary data.



When converting the data into binary, the binary data starting from the 7th bit of the Low byte must be shifted to the left by one place to reserve the position of the parity bit.



If the data has already odd number of ones, the parity bit is 0, otherwise it is set to 1.



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7.1 *Parity Code Example*

```
 bool Inno3Pro_OddParity(uint8_t u8OddParity)
{
        u8OddParity ^= (u8OddParity >> 4);
        u8OddParity ^= (u8OddParity >> 2);
        u8OddParity ^= (u8OddParity >> 1);
        return u8OddParity & 1;
}

void Inno3Pro_Encode_Buffer_Parity( uint16_t u16Temp,
                                                uint8_t *u8WriteBuffer)
 {
        uint16_t u16TempMsb = 0;
        uint8_t u8ConvertedMsb = 0;
        uint8_t u8ConvertedLsb = 0;

        // Clears Bit 0-6 and Shift the remaining to left by 1
        // The 7th Bit is used for Parity Purposes
        // Example for 5V : 01F4 Hex (500 in decimal) , Returns 0x300
        u16TempMsb = (u16Temp & 0xFF80) << 1;

        // Begin MSB Extraction
        // From 0x300 , Returns 0x03
        u8ConvertedMsb = (u16TempMsb & 0xFF00) >> 8;


        // Check Odd Parity and Fill the MSB buffer
        if(Inno3Pro_OddParity(u8ConvertedMsb))
        {
                // No of Zero is Odd
                u8WriteBuffer[1] = u8ConvertedMsb;
        }
        else
        {
                // No of Zero is Even
                u8WriteBuffer[1] = set_bit(u8ConvertedMsb,7);
        }

        // Clears 7th Bit, This is used for parity purposes
        // Example for 5V : 01F4 Hex (500 in decimal) , Returns 0x74
        u8ConvertedLsb = (u16Temp & 0x7F);

        // Check Odd Parity and Fill the LSB buffer
        if(Inno3Pro_OddParity(u8ConvertedLsb))
        {
                // No of Zero is Odd
                u8WriteBuffer[0] = u8ConvertedLsb;
        }
        else
        {
                // No of Zero is Even
                u8WriteBuffer[0] = set_bit(u8ConvertedLsb,7);
```


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```
        }
}
```

8 Command Sequences

In order to update the Output Voltage (CV) and Constant Current (CC), certain sequences of commands are needed to be followed in order to avoid inadvertent triggering of UV or OV faults.

8.1 *Voltage Increment Process*

When the output voltage is incremented to a higher value, if the OVA is not increased to a value higher than the new CV value before increasing the present CV value, then it will trigger OV protection. So the OVA needs to be programmed prior to programming the CV register.

For power supplies initially running at low output voltage and high output current condition, which would need transitioning to a high output voltage and low output current condition, if the CC setpoint is not reduced before raising the voltage, then the power supply could get power limited for drawing high load at high output conditions. So the CC needs to be programmed before raising the CV voltage.

However, if the load at which the power supply is running for the present CV value is higher than the new CC value to be programmed, then it could lead to CC operation of the power supply at the new increased output voltage. In the CC operation of the power supply, if the output voltage drops below the present UVA setpoint then it could trigger UV protection. So care should be taken in such conditions and the load could be reduced before doing such transitions.

The figure below shows the command sequence for incrementing a voltage to a higher value, with 10ms update limit (Fast VI Command) initially disabled. A minimum of 150 us delay between consecutive commands through the I^2C bus is still required between all command regardless of the status of the Fast VI Command register.

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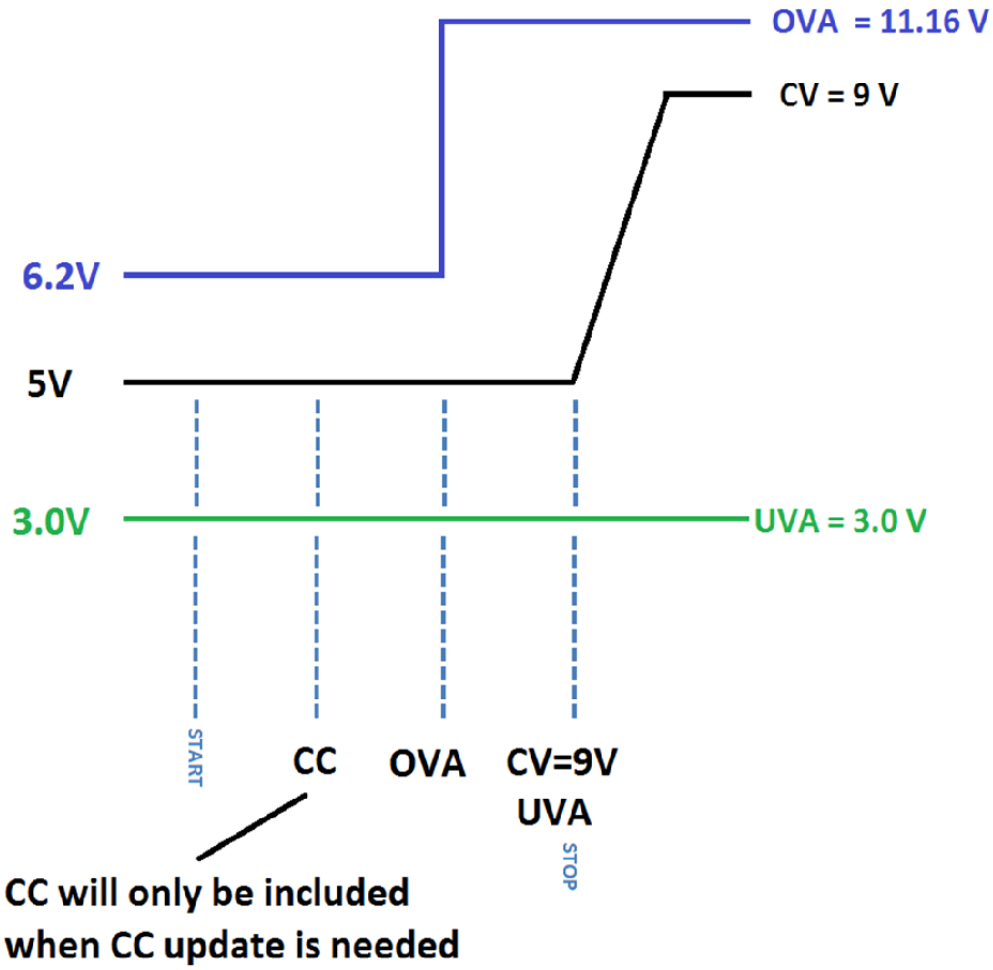

In the above figure, CC is programmed first. Then OVA must be set to a higher value prior to updating the CV register. After programming CV, UVA updated must be updated to a lower than CV.

In this example, the OVA setting gets updated depending on the value of programmed CV. This configuration tracks the output voltage.

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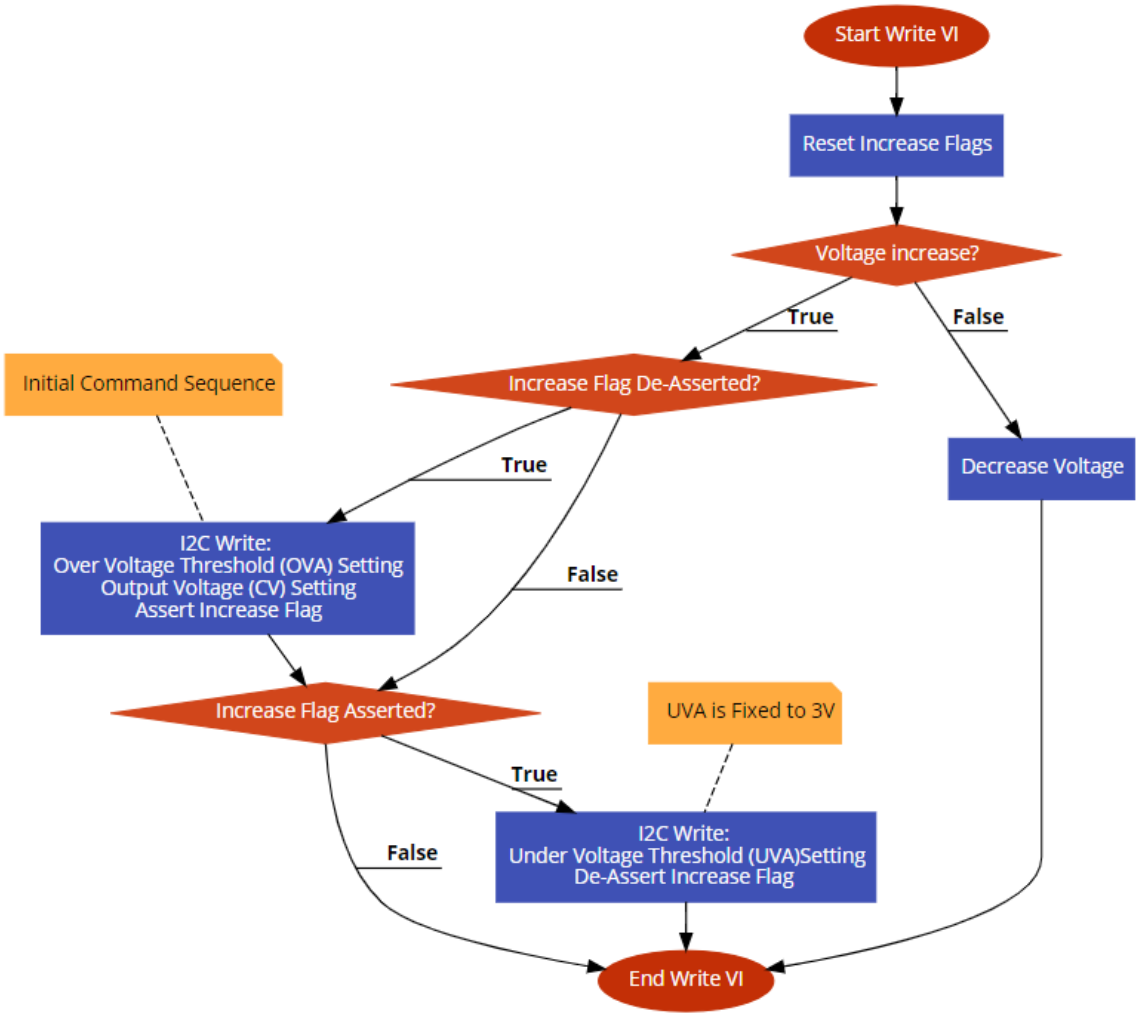
8.1.1 Voltage Increment Flowchart



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8.1.2 Voltage Increment Code Example

```
//Voltage Increase Routine
if(bVoltIncrease)
{
  //Initial Command Sequence
  if(!bControlFlag_Increase)
  {
    I2C_Write16(INNO3PRO_ADDRESS ,INNO3PRO_OVA ,u8_Buffer_OVA ,WR_WORD);
    I2C_Write16(INNO3PRO_ADDRESS ,INNO3PRO_CV ,u8_Buffer_CV ,WR_WORD);

    bControlFlag_Increase = true;
  }

  if(bControlFlag_Increase)
  {
          //Check If Vout already reached 90% of the desired Set Point
          //if(Inno3Pro_Read_Volts() >(Inno3Pro_Get_Register_CV()*0.9))
         {

           //UVA must be written only after New Voltage Setpoint was reached, UVA is Fixed to 3V
           I2C_Write16(INNO3PRO_ADDRESS ,INNO3PRO_UVA ,u8_Buffer_UVA ,WR_WORD);

         //New Set Point Was Reached
         bVoutIncOk = true;

          bControlFlag_Increase = false;
         }
   }

        //Return Increment Voltage Status
        return bVoutIncOk;

}
```


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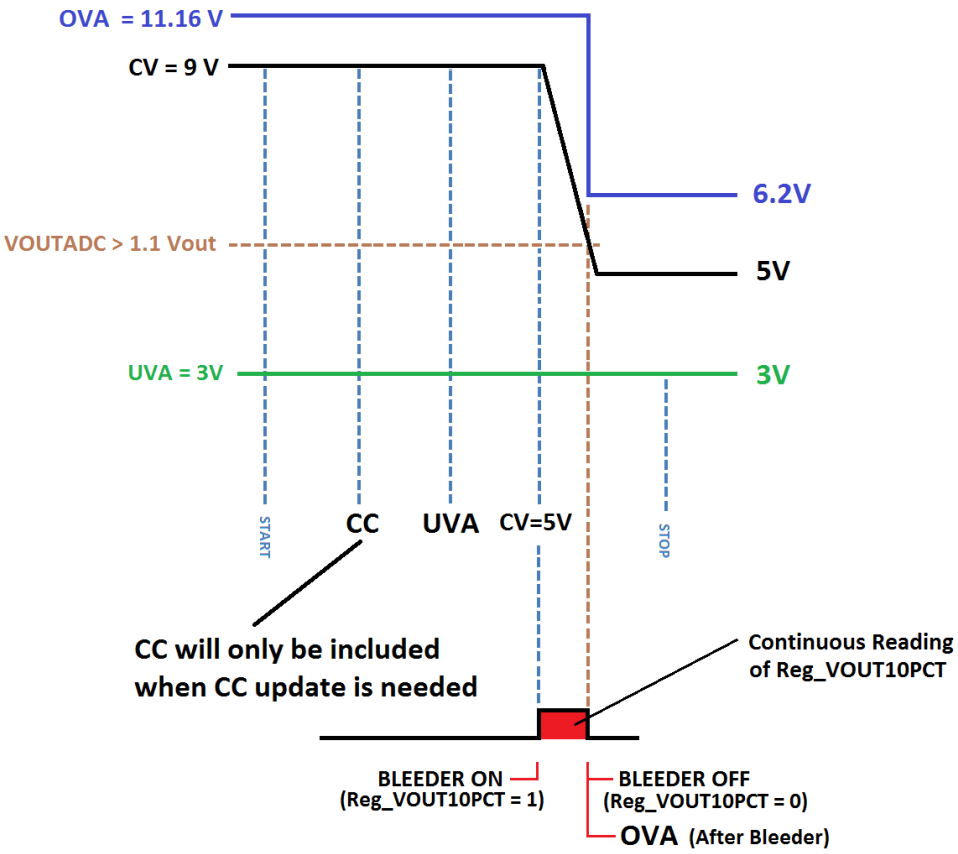
8.2 *Voltage Decrement Process*

When output voltage is decremented to a lower value, BLEEDER needs to be enabled for a faster transition of output voltage especially at no load conditions. If the BLEEDER is not turned on from higher voltage to lower voltage transitions (20 V to 5 V), then the long transition time (with no switching activity) could trigger an auto restart of the InnoSwitch3-Pro IC. The BLEEDER needs to be turned OFF as soon as the voltage reaches the desired set point otherwise it could lead to undesirable power dissipation and heating of the IC.

Usually high load current can be drawn at lower output voltages compared to higher output voltages for the same power ratings. Therefore, while transitioning to a lower output voltage, it is recommended to first increase the CC setpoint limit before lowering the output voltage. This prevents the power supply from entering into constant current mode of operation, especially if it had been operating in constant power mode region before the transition. Unexpected operation of the power supply in CC mode of operation due to not increasing the CC limit before the transition could also trigger UV protection if the output voltage falls below the UVA.



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In the above figure, CC is programmed first. The UVA needs to be then set to a value lower than the desired new CV setpoint before updating the CV register. After the CV register is updated, the strong bleeder is enabled immediately. On enabling the bleeder, the output voltage should be continuously monitored to check if it reached 110% of the programmed CV value. When this condition is met, VOUT10PCT bit of the READ10 register (which was initially set for voltages > 110% target voltage) gets cleared. Once it is confirmed that the VOUT10PCT bit is cleared, the bleeder must be turned off to prevent unwanted power dissipation in the controller. OVA setpoint should be updated only after the bleeder is turned off so as to prevent OVP trigger.

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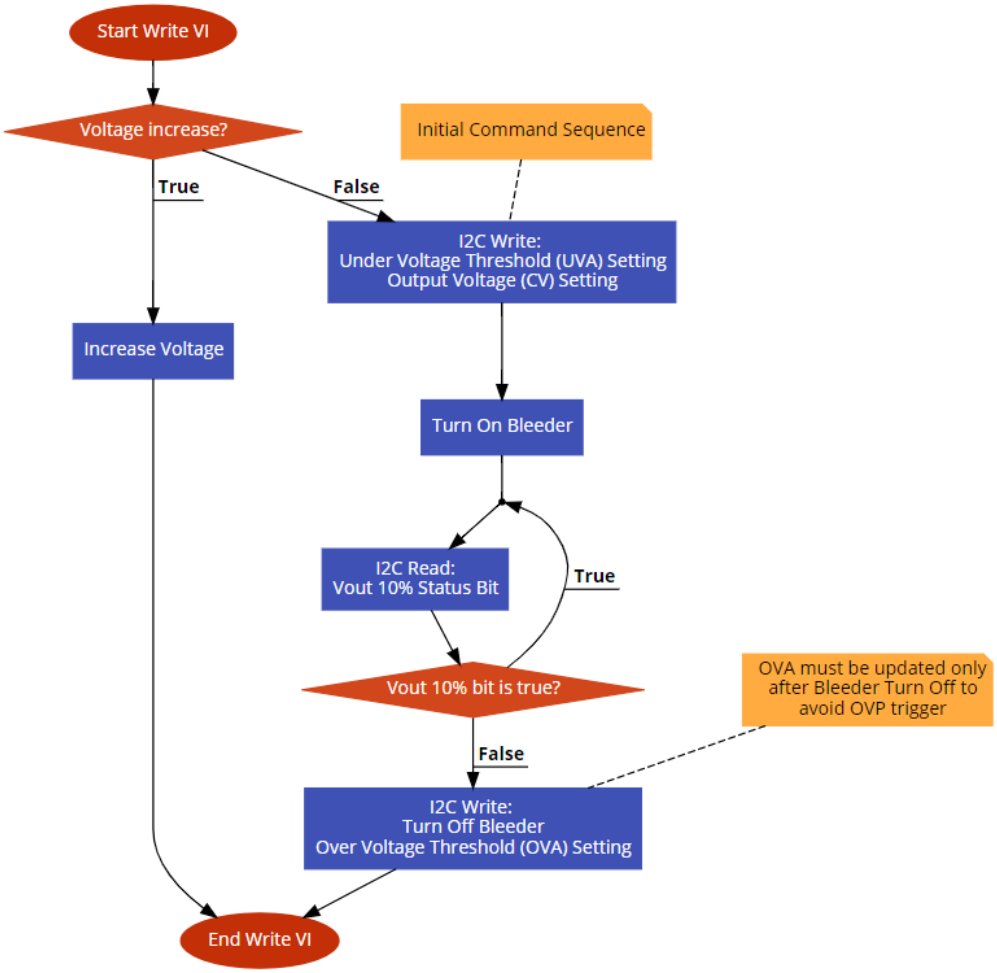
8.2.1 Voltage Decrement Flowchart



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8.2.2 Voltage Decrement Code Example

```
else //Voltage Decrease Routine
{
      // UVA is Fixed to 3V
      I2C_Write16(INNO3PRO_ADDRESS ,INNO3PRO_UVA ,u8_Buffer_UVA ,WR_WORD);
      I2C_Write16(INNO3PRO_ADDRESS ,INNO3PRO_CV ,u8_Buffer_CV ,WR_WORD);

      // Immediately Executed after CV
      // Turn on Bleeder
      Inno3Pro_Bleeder_Enable(true);


      Do
      {
            bVout10pct_Flag = Inno3Pro_Read_Status_Vout10pct();

      } while (bVout10pct_Flag == true);


            //Disable Bleeder
            Inno3Pro_Bleeder_Enable(false);

            //OVA must be after Bleeder Turn Off to avoid OVP trigger
            I2C_Write16(INNO3PRO_ADDRESS ,INNO3PRO_OVA ,u8_Buffer_OVA ,WR_WORD);

            //New Set Point Was Reached
            bVoutDecOk = true;

  }

         //Return Decrement Voltage Status
         return bVoutDecOk;

}
```


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9 Use of Timers

9.1 *Fast VI Command Timer*

The 10ms update limit for consecutive commands to set the output Voltage/Current can be disabled when necessary. Consecutive CV and CC I^2C write Commands cannot be sent faster than 10ms.

By default the speed of CV/CC update is enabled, the firmware implementation must have a Timer Clock that takes care of the necessary timings and delays involved. This is usually a 1ms timer that runs on an interrupt.

9.1.1 Voltage Increment with CV/CC Update Limit Enabled

Example below has 12ms between CV and CC I^2C write commands.

```
//Voltage Increase Routine
if(bVoltIncrease)
{
    if(clock_HasTimeElapsedMs(u16_Config_Timer_Hi,INNO3PRO_VI_STATE_DELAY)) //Delay Time
    {
        switch(u16_Config_State_Hi)
        {
            case 0:      break;    //delay
                                   //I2C ADDRESS         ,PI COMMAND     LSB and MSB     TYPE
            case 1:      I2C_Write16(INNO3PRO_ADDRESS   ,INNO3PRO_CC    ,u8_Buffer_CC   ,WR_WORD); break;
            case 2:      I2C_Write16(INNO3PRO_ADDRESS   ,INNO3PRO_OVA   ,u8_Buffer_OVA  ,WR_WORD); break;
            case 3:      I2C_Write16(INNO3PRO_ADDRESS   ,INNO3PRO_CV    ,u8_Buffer_CV   ,WR_WORD); break;
            case 4:      I2C_Write16(INNO3PRO_ADDRESS   ,INNO3PRO_UVA   ,u8_Buffer_UVA  ,WR_WORD); break;
            default:     break;
        }

        u16_Config_State_Hi++;
        u16_Config_Timer_Hi = clock_GetTimeStampMs(); //Reset Timer

        //Maximum Time to complete voltage transitions
        if(u16_Config_State_Hi > INNO3PRO_OUTPUT_HI_TIME) //Delay
        {

            //Reset variables
            u16_Config_State_Hi = 0;
            u16_Config_Timer_Hi = 0;
            return true;
        }
        else
        {
            return false;
        }
    }

}
```

Macro:

```
#define INNO3PRO_VI_STATE_DELAY             (uint16_t)(6)
```


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9.1.2 Voltage Decrement with CV/CC Update Limit Enabled

```
else //Voltage Decrease Routine
{

    if(clock_HasTimeElapsedMs(u16_Config_Timer_Lo,INNO3PRO_VI_STATE_DELAY)) //Delay Time
    {

            switch(u16_Config_State_Lo)
            {

                case 0:
                            break;
                                        //I2C ADDRESS        ,PI COMMAND     LSB and MSB     TYPE
                case 1:     I2C_Write16(INNO3PRO_ADDRESS    ,INNO3PRO_CC    ,u8_Buffer_CC   ,WR_WORD);
                            break;

                case 2:     I2C_Write16(INNO3PRO_ADDRESS    ,INNO3PRO_UVA   ,u8_Buffer_UVA  ,WR_WORD);
                            break;

                case 3:     I2C_Write16(INNO3PRO_ADDRESS    ,INNO3PRO_CV    ,u8_Buffer_CV   ,WR_WORD);

                            //Bleeder Turn On Control
                            //Immediately Executed after CV
                            //Enable Bleeder
                            u8_Buffer_BLEEDER[0] = 0x01;
                            u8_Buffer_BLEEDER[1] = 0x00;

                            //Write Bleeder ON
                            I2C_Write16(INNO3PRO_ADDRESS    ,INNO3PRO_BLEEDER   ,u8_Buffer_BLEEDER   ,WR_WORD);
                            bBleederTurnOffCntrl = true;
                            break;
                default:
                            break;
            }


        u16_Config_State_Lo++;                          //Increment State Count
        u16_Config_Timer_Lo = clock_GetTimeStampMs();   //Reset Timer

        //Bleeder Turn Off Control
        if(bBleederTurnOffCntrl)
        {
            if(!Inno3Pro_VOUT10PCT_Enabled())
            {
                //Disable Bleeder
                u8_Buffer_BLEEDER[0] = 0x00;
                u8_Buffer_BLEEDER[1] = 0x00;

                //Write Bleeder OFF
                I2C_Write16(INNO3PRO_ADDRESS    ,INNO3PRO_BLEEDER   ,u8_Buffer_BLEEDER   ,WR_WORD);

                //OVA must be executed after Bleeder Turn Off to avoid OVP trigger
                I2C_Write16(INNO3PRO_ADDRESS    ,INNO3PRO_OVA      ,u8_Buffer_OVA   ,WR_WORD);

                bVOUT10PCT_disabled = true;
            }
        }

        //Maximum Time to complete voltage transition
        //Must be longer than bleeder turn OFF
        if(bVOUT10PCT_disabled)
        {
            //Reset all variables
            u16_Config_State_Lo = 0;
            u16_Config_Timer_Lo = 0;
            bBleederTurnOffCntrl = false;
            bVOUT10PCT_disabled = false;

            return true;
        }
        else
        {
            return false;
        }
    }
}
```


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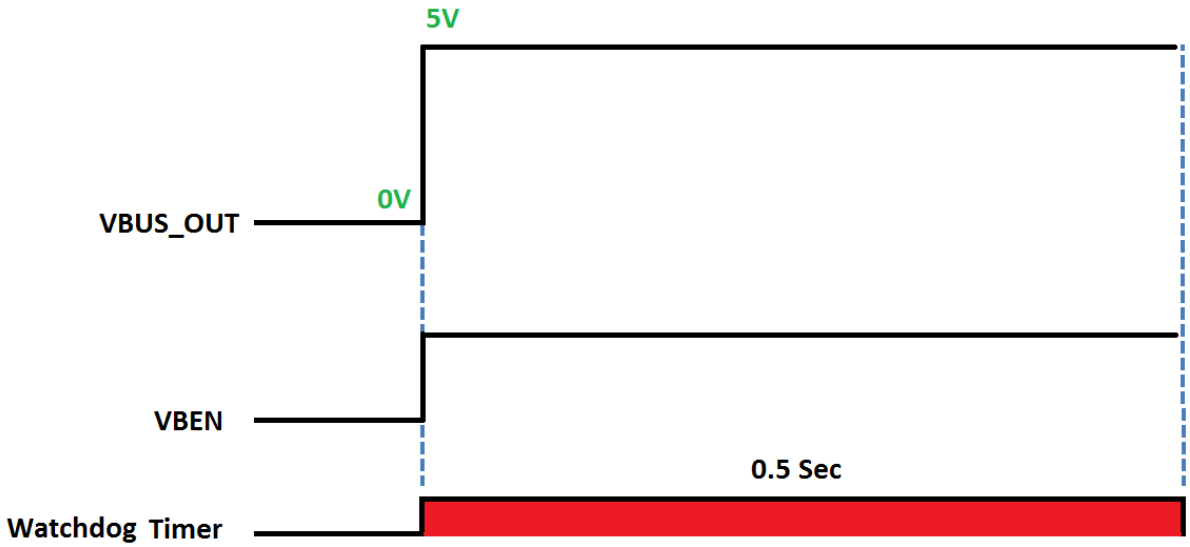
9.2 *Watchdog Timer*

By default, the watchdog timer is enabled for 0.5 s. Within this time period, at least a single I^2C transaction is required to prevent the InnoSwitch3-Pro from going back to the default reset state.



*At least 1 Read or Write I^2C Transaction
*Possible Continuous Readback of Telemetry Registers

9.2.1 Watchdog Code Example

```
void main (void)
{
    // Initialize the device - PIC16F18325
    SYSTEM_Initialize();
    INTERRUPT_GlobalInterruptEnable();
    INTERRUPT_PeripheralInterruptEnable();

    //Write Initial Commands to Inno3-Pro
    Inno3Pro_Initialization();


    //Call the Functions on the Main Loop
    while (1)
    {
        //Inno3-Pro Control Functions
        Inno3Pro_Write_VI(5 ,5.3);              // 5V and 5.3A
        Inno3Pro_Vbus_Switch_Control(3);        // VBEN Enable

        Inno3Pro_ReadVolts();                   //Continuously Measure Voltage
        Inno3Pro_ReadAmps();                    //Continuously Measure Current
    }
}
```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10 Telemetry / Read Back

The I^2C Master can use the telemetry registers to read the user programmed registers, monitor and measure the output parameters, update the device protection features and detect fault conditions.

Prior to using the Telemetry, I^2C Read/Write drivers must be set according to the data sheet of the microcontroller being used.

10.1 *System Ready Signal*

Prior to the start of any I^2C transactions, the InnoSwitch3-Pro must indicate that it is ready to receive I^2C commands. This can be monitored by reading the status of Reg_control_s bit on READ10 Register. An assertion to this bit means the InnoSwitch3-Pro is ready to communicate and accept commands.

10.1.1 System Ready Code Example

```
 bool Inno3Pro_Read_Status_SystemReady(void)
{
   // Read10, System Ready Signal
   return Inno3Pro_Read_Bit(INNO3PRO_READ10,READ10_Reg_CONTROL_S);
}
```


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10.2 *VOUT 10% Signal*

Whenever the output voltage transitions from a high to low voltage set point, at the start of each transition, InnoSwitch3-Pro asserts VOUT10PCT. The device monitors the Output Voltage ADC and then clears the Reg_VOUT10PCT register when the output voltage settles to less than 10% of the set regulation threshold.

10.2.1 V_{OUT} 10% Code Example

```
 bool Inno3Pro_Read_Status_Vout10pct(void)
{
   // Read10, VOUTADC > 1.10 * Vout
   return Inno3Pro_Read_Bit(INNO3PRO_READ10,READ10_Reg_VOUT10PCT);
}
```


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10.3 *I2C Read Back Code Example*

10.3.1 General Telemetry

```
 uint16_t Inno3Pro_Telemetry(uint8_t ReadBack_Address)
{
        uint16_t u16TempRead = 0;
        u16TempRead = I2C_Read16(INNO3PRO_ADDRESS,ReadBack_Address);
        return u16TempRead;
}
```

Inno3Pro_Telemetry function is an API for reading the desired register address. It uses I^2C_Read16 function which is an I^2C driver created for the InnoSwitch3-Pro. When this function is used to read the value of a telemetry register, it returns a value of the MSB and then followed by the LSB.

Example (5V – 0x01F4)

10.3.2 Read Bit Telemetry

```
 bool Inno3Pro_Read_Bit(uint8_t ReadBack_Address, uint8_t Bit)
{
        uint16_t u16TempRead = 0;
        u16TempRead = I2C_Read16(INNO3PRO_ADDRESS,ReadBack_Address);

        if(test_bit(u16TempRead,Bit))
        {
                return true;
        }
        else
        {
                return false;
        }
}
```

Inno3Pro_Read_Bit function is an API for reading the desired bit of a telemetry register. This uses I^2C_Read16 function which is an I^2C driver created for the InnoSwitch3-Pro. When this function is used to read the specific bit of a telemetry register, it returns a value of true when the bit is 1 or false when the bit is 0.

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10.3.3 Read Byte Telemetry

```
 uint8_t Inno3Pro_Read_Byte(uint8_t ReadBack_Address, bool bHighByte)
{
        uint16_t u16TempRead = 0;
        u16TempRead = I2C_Read16(INNO3PRO_ADDRESS,ReadBack_Address);

        if(bHighByte)
        {
                return (u16TempRead & 0xFF00)>>8;
        }
        else
        {
                return (u16TempRead & 0xFF);
        }
}
```

Inno3Pro_Read_Byte function is an API for reading the desired byte of a telemetry register. It also uses I^2C_Read16 function which is an I^2C driver created for the InnoSwitch3-Pro. The user has the option to select the byte to read either the MSB or LSB.

10.3.4 Read 2 bits Telemetry

```
 uint8_t Inno3Pro_Read_2Bits(uint8_tReadBack_Address,
                                        uint8_t u8ShiftCnt)
{
         uint16_t u16TempRead = 0;

        u16TempRead = Inno3ProSend.I2C_Read16(INNO3PRO_ADDRESS,ReadBack_Address);

        return ((u16TempRead >> u8ShiftCnt)& 0x03) ;
}
```

Inno3Pro_Read_2BITS function is an API for reading 2 bits in a byte of a telemetry register.

10.3.5 Read Set Point and Threshold

```
float Inno3Pro_Read_SetPoint(uint16_tReadBack_Address ,
                                        float fMultiplier)
{
        uint16_t u16TempReadValue = 0;
        uint16_t u16ConvertedValue = 0;
        u16TempReadValue = Inno3Pro_Telemetry(ReadBack_Address);

        //MSB //LSB
        u16ConvertedValue = ((u16TempReadValue & 0x7F00)>>1) +
```


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```
                                        (u16TempReadValue & 0x7F);
        return (float) (u16ConvertedValue / fMultiplier);
}
```

Inno3Pro_Read_SetPoint function is used for reading Voltage Related Readbacks

10.4 *Read Voltage Code Example*

```
float Inno3Pro_Read_Volts(void)
{
        uint16_t u16TempReadValue = 0;
        uint16_t u16ConvertedValue = 0;

        // Read9, Measured Output Voltage
        u16TempReadValue = Inno3Pro_Telemetry(INNO3PRO_READ9);

       //Bit Manipulation: Clear the Bit[15:12] , use Bit [11:0]
       u16ConvertedValue = (u16TempReadValue & 0x0FFF);

        //Calculate Reading - 1F4 Hex -> 500 Decimal , 500 / 100 = 5V
        return (float) (u16TempReadValue / INNO3PRO_CV_SET_PT_MULT);
}

float Inno3Pro_Read_VoltsAverage(void)
{
        uint16_t u16TempReadValue = 0;
        uint16_t u16ConvertedValue = 0;

        // Read14, Measured Output Voltage
        u16TempReadValue = Inno3Pro_Telemetry(INNO3PRO_READ14);

       //Bit Manipulation: Clear high nibble of MSB - Bit[15:12]
       //, use Bit [11:0]
       u16ConvertedValue = (u16TempReadValue & 0x0FFF);

        //Calculate Reading - 1F4 Hex -> 500 Decimal , 500 / 100 = 5V
        return (float) (u16TempReadValue / INNO3PRO_CV_SET_PT_MULT);
}
```

In the above example, measured output voltage reading uses the Inno3Pro_Telemetry function with a parameter of register READ9. At start-up, the output voltage is 5 V by default. When a read command is executed, we expect the LSB to be 0xF4 and the MSB to be 0x01. Using Inno3Pro_Telemetry function, we get 0x01F4 which translates to 500 in decimal. Dividing this by 100, will result in 5 V reading.

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10.5 *Read Current Example*

```
 float Inno3Pro_Read_Amps(void)
{
          uint16_t u16TempReadValue = 0;
          uint16_t u16ConvertedValue = 0;

          // Read7, Measured Output Current
          u16TempReadValue = Inno3Pro_Telemetry(INNO3PRO_READ7);

         //Bit Manipulation: MSB- Clear the Bit [15:9]
     u16ConvertedValue = ((u16TempReadValue & 0x0100) >> 1) +

                                    //LSB - Clear bit 7 (Parity)
                                    (u16TempReadValue & 0x7F);

          //Sensed Current Value = N (Decimal) x 32 / (Rsense * 128)
          //Calculate Reading:
          //Sensed Current Value = (58 x 32) / (5 * 128 ) = 2.9 Amps

     return(float)
     (
               (u16ConvertedValue*INNO3PRO_FULL_RANGE_RSENSE_VOLTAGE)/
               (INNO3PRO_RSENSE * INNO3PRO_ADC_FULL_RANGE)
     );
}

 float Inno3Pro_Read_AmpsAverage(void)
{
          uint16_t u16TempReadValue = 0;
          uint16_t u16ConvertedValue = 0;

          // Read13, Measured Output Current
          u16TempReadValue = Inno3Pro_Telemetry(INNO3PRO_READ13);

         //Bit Manipulation: Clear the MSB , use LSB only - Bit[7:0]
         u16ConvertedValue = (u16TempReadValue & 0x00FF);

          //Sensed Current Value = N (Decimal) x 32 / (Rsense * 128)
          //Calculate Reading:
          //Sensed Current Value = (58 x 32) / (5 * 128 ) = 2.9 Amps

     return(float)
     (
               (u16ConvertedValue*INNO3PRO_FULL_RANGE_RSENSE_VOLTAGE)/
               (INNO3PRO_RSENSE * INNO3PRO_ADC_FULL_RANGE)
     );
}
```


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11 Code Library

To simplify the technicalities on controlling the InnoSwitch3-Pro, a simple code library is provided as a reference.

The library contains all the registers needed for controlling the device. These registers are organized as Command Registers and Telemetry registers. Command registers are sent to the device for performance control and Telemetry Registers are for reading back values.

Computation Macros are presented to aid in setpoint calculations. Register default values are also defined to simplify writing to the required registers at device initialization.

11.1 *PIC16F18325 MCU Implementation*

11.1.1 Step-By-Step Procedure

11.1.1.1 Header Files Inclusion

The Library header files contain all of the function declarations and macro definitions. This must be included in the main page as shown.

```
#include "Drv_Rtc.h"
#include "Drv_i2c.h"
#include "Inno3Pro.h"
#include "Config.h"
```

11.1.1.2 InnoSwitch3-Pro Initialization

Before continuous execution of the main code, the status of System Ready Signal is monitored to ensure the InnoSwitch3-Pro is ready to receive I^2C commands. Afterwards initialization commands can be sent to the device to re-configure the default settings as needed. This initialization routine disables the watchdog timer and Fast VI Limit. UVL timer is also initialized to 64ms.

```
Inno3Pro_Initialization();

void main(void)
{
   //Main Loop Codes
}
```


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11.1.1.3 Control Functions Set-up

Updates the Output Voltage and Constant Current Setting

- Follows a certain sequence of I2C commands in order to avoid inadvertent triggering of UV or OV faults
- Controls the VOUT pin strong bleeder when Decreasing the voltage from High to Low Setting
- Automatically updates the Over Voltage (OVA) and Under Voltage (UVA) settings
  OVA is 124% of CV Setpoint
  UVA is Fixed to 3V Setting

```
Inno3Pro_Write_VI( Volts, Amps )
```

Updates the Output Voltage without Bleeder Control

```
Inno3Pro_Write_Volts( Volts )
```

Sets the Constant Current Setting

```
Inno3Pro_Write_Amps( Amps )
```

Sets the Over Voltage Setting

```
Inno3Pro_Write_Over_Volts( Value )
```

Sets the Under Voltage Setting

```
Inno3Pro_Write_Under_Volts( Value )
```

Sets the Cable Drop Compensation Value

```
Inno3Pro_Write_Cable_Drop_Comp( Value )
```

Sets the Constant Output Power Threshold

```
Inno3Pro_Write_Volt_Peak( Value )
```

Used for Turning On or Off the Bus Voltage Switch

```
Inno3Pro_Vbus_Switch_Control( Value )
```

Used for Turning On or Off the VOUT pin strong bleeder

- The BLEEDER must not be enabled for extended period of time to prevent excessive power dissipation in the controller

```
Inno3Pro_Bleeder_Enable( Value )
```


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11.1.1.4 Telemetry Functions Setup

Use the Telemetry Functions On the Main Loop to Read the Registers of InnoSwitch3-Pro.

Used fpr Reading the desired Register Address

```
Inno3Pro_Telemetry(Register_Address)
```

Used for Reading the Specific Bit of Telemetry Register

```
Inno3Pro_Read_Bit(Register_Address, Bit)
```

Tells when InnoSwitch3-Pro is ready to communicate and accept commands

```
Inno3Pro_Read_Status_SystemReady()
```

Returns the measured output voltage

```
Inno3Pro_Read_Volts()
```

Returns the measured output current

```
Inno3Pro_Read_Amps()
```

Returns the VOUT10PCT status information

- VOUT10PCT status is used to disable the VOUT pin strong bleeder

```
Inno3Pro_Read_Status_Vout10pct()
```

Returns the VOUT2PCT status information

- VOUT10PCT status is also used to disable the VOUT pin strong bleeder

```
Inno3Pro_Read_Status_Vout2pct()
```


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11.1.1.5 Basic Code Example

This code example is to demonstrate the basic usage of InnoSwitch3-Pro Code Library.

- Initial commands are sent using the InnoSwitch3-Pro Initialization Routine.
- The Main Routine sets the output voltage to 5V and constant current current to 6A.
- Cable Drop Compensation is programmed to 300mV.
- Constant power is knee voltage is set to 7V and then Vbus Switch is turned ON

```
//MPLAB Code Configurator Header File
#include "mcc_generated_files/mcc.h"

//Step  1  :  Add the Header Files
#include "Code/Drv_i2c.h"
#include "Code/Drv_Rtc.h"
#include "Code/Config.h"
#include "Code/Inno3Pro.h"


void main(void)
{
    // Initialize the device - PIC16F18325
    SYSTEM_Initialize();
    INTERRUPT_GlobalInterruptEnable();
    INTERRUPT_PeripheralInterruptEnable();

    //Step 2 :  Write Initial Commands to InnoSwitch3-Pro
    Inno3Pro_Initialization();

    //Step 3 :  Call the Functions on the Main Loop
    while (1)
    {
      // Main Loop Variable Initialization
      float fVolts = 5;                         //Initialize Voltage at 5V
      float fAmps = 6;                          //Initialize Constant Current at 6A
      float fCableDropComp = 300;               //Initialize Cable Drop Compensation to 300mv
      float fVoltPeak = 7;                      //Initialize Knee Voltage at 7V
      float fVbusEn = 3;                        //Initialize Vbus Enable to ON

      //Library Call in the Mainloop
      Inno3Pro_Write_VI               ( fVolts   , fAmps   );     //Set Voltage and current
      Inno3Pro_Write_Cable_Drop_Comp  ( fCableDropComp    );     //Set Cable Drop Compensation
      Inno3Pro_Write_Volt_Peak        ( fVoltPeak         );     //Set Constant Output Power Knee Voltage
      Inno3Pro_Vbus_Switch_Control    ( fVbusEn           );     //Set Vbus Enable
    }
}
```


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11.1.2 I^2C Drivers

I^2C drivers must be correctly configured depending on the microcontroller being used. This must be configured to meet the I^2C packet format on the InnoSwitch3-Pro datasheet for Write and Read transactions. Every I^2C transaction has at least a 150 usec delay between commands.

11.1.2.1 I2C Write Code Example

```
int I2C_Write16(uint16_t slaveAddress, uint8_t dataAddress, uint8_t *dataBuffer, uint8_t buflen)
{
    //150us Delay On Every I2C Transaction
    __delay_us(150);

    uint8_t writeBuffer[3];
    I2C1_MESSAGE_STATUS status = I2C1_MESSAGE_PENDING;

    //Set Address as the bytes to be written first
     writeBuffer[0] = dataAddress;

    //Limt Buffer Length
    if(buflen > 3)
    {
        buflen = 3;
    }

    //Copy data bytes to write buffer
     writeBuffer[1] = dataBuffer[0];
     writeBuffer[2] = dataBuffer[1];

    //Set up for ACK polling
    timeOut = 0;

    while(status != I2C1_MESSAGE_FAIL)
    {
            // Initiate a write to Device
            I2C1_MasterWrite(writeBuffer,buflen,slaveAddress,&status);

            // wait for the message to be sent or status has changed.
            while(status == I2C1_MESSAGE_PENDING);

            // if transfer is complete, break the loop
            if (status == I2C1_MESSAGE_COMPLETE)
            {
                break;
            }
                // if transfer fails, break the loop
            if (status == I2C1_MESSAGE_FAIL)
            {
                break;
            }

            //check for max retry and skip this byte
            if (timeOut == MAX_RETRY)
            {
                break;
            }
            else
            {
                timeOut++;
            }
    }

    // if the transfer failed, stop at this point
    if (status == I2C1_MESSAGE_FAIL)
    return 1;

}
```


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11.1.2.2 I2C Read Code Example

```
uint16_t I2C_Read16(uint16_t slaveAddress, uint8_t dataAddress)
{

    int check = 0;
    I2C1_MESSAGE_STATUS status = I2C1_MESSAGE_PENDING;

    uint8_t buflen = 0x02;          //Read 2 Bytes
    uint8_t writeDataBuffer[2];     //Write Buffer Array
    uint8_t readDataBuffer[2];      //Read Buffer Array
    uint16_t u16Lsb;                //Storage Variable for LSB Reading
    uint16_t u16Msb;                //Storage Variable for MSB Reading


    //Copy data bytes to write buffer
     writeDataBuffer[0] = dataAddress;
     writeDataBuffer[1] = dataAddress;

    //I2C_Write16 has a 150us Delay Inside - Needed for Every I2C Transaction
    //Write Address from where to read
    //                  I2C ADDRESS ,PI COMMAND  ,Buffer          ,Length
    check = I2C_Write16(slaveAddress  ,0x80        ,writeDataBuffer ,0x03);

    //check if address write is successful
    if(check == 1)
        return;

    //Set up for ACK polling
    timeOut = 0;

    //150us Delay On Every I2C Transaction
    __delay_us(150);

    while(status != I2C1_MESSAGE_FAIL)
    {
        // Initiate a Read to Device
        I2C1_MasterRead(readDataBuffer,buflen,slaveAddress,&status);

        // wait for the message to be sent or status has changed.
        while(status == I2C1_MESSAGE_PENDING);

        // if transfer is complete, break the loop
        if (status == I2C1_MESSAGE_COMPLETE)
        {
            break;
        }


        // if transfer fails, break the loop
        if (status == I2C1_MESSAGE_FAIL)
        {
                break;
        }

        // check for max retry and skip this byte
        if (timeOut == MAX_RETRY)
        {
            break;
        }
        else
        {
                timeOut++;
        }
    }

    ret = readDataBuffer[0];        // receive DATA
    ret <<= 8;
    ret |= readDataBuffer[1];       // receive DATA
    return ret;
}
```

11.1.2.3

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11.2 *Arduino Implementation*

11.2.1 Step-By-Step Procedure

11.2.1.1 Header Files Inclusion

The library header files contain all of the function declarations and macro definitions. This must be included in the main page as shown.

```
#include <Drv_Rtc.h>
#include <Drv_i2c.h>
#include <Inno3Pro.h>
#include <Config.h>
```

11.2.1.1 Class Instance Creation

Construct a Class instance to call the functions inside **Inno3Pro_Application**.
Constructing a Class instance of **Inno3Pro_Rtc** is Optional.

```
Inno3Pro_Application     Inno3ProApp;
Inno3Pro_Rtc             Inno3ProClk;
```

11.2.1.2 InnoSwitch3-Pro Initialization

Before continuous execution of the main code, the status of System Ready Signal is monitored to ensure the InnoSwitch3-Pro is ready to receive I^2C commands. Afterwards initialization commands can be sent to the device to re-configure the default settings as needed. This initialization routine disables the watchdog timer and Fast VI Limit. UVL timer is also initialized to 64 ms.

The 400 kHz clock frequency for I^2C communication is set-up on initialization.

```
void setup ()
{
        Inno3ProApp.Inno3Pro_Initialization();
}
```


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11.2.1.3 Control Functions Set-up

Updates the Output Voltage and Constant Current Setting

- Follows a certain sequence of I^2C commands in order to avoid inadvertent triggering of UV or OV faults
- Controls the VOUT pin strong bleeder when Decreasing the voltage from High to Low Setting
- Automatically updates the Over Voltage (OVA) and Under Voltage (UVA) settings
  OVA is 124% of CV Setpoint
  UVA is Fixed to 3 V Setting

```
Inno3Pro.Inno3Pro_Write_VI( Volts, Amps )
```

Updates the Output Voltage without Bleeder Control

```
Inno3Pro.Inno3Pro_Write_Volts( Volts )
```

Sets the Constant Current Setting

```
Inno3Pro.Inno3Pro_Write_Amps( Amps )
```

Sets the Over Voltage Setting

```
Inno3Pro.Inno3Pro_Write_Over_Volts( Value )
```

Sets the Under Voltage Setting

```
Inno3Pro.Inno3Pro_Write_Under_Volts( Value )
```

Sets the Cable Drop Compensation Value

```
Inno3Pro.Inno3Pro_Write_Cable_Drop_Comp( Value )
```

Sets the Constant Output Power Threshold

```
Inno3Pro.Inno3Pro_Write_Volt_Peak( Value )
```

Used for Turning On or Off the Bus Voltage Switch

```
Inno3Pro.Inno3Pro_Vbus_Switch_Control( Value )
```

Used for Turning On or Off the VOUT pin strong bleeder

- The BLEEDER must not be enabled for extended period of time to prevent excessive power dissipation in the controller

```
Inno3Pro.Inno3Pro_Bleeder_Enable ( Value )
```


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11.2.1.4 Basic Code Example

This code example is to demonstrate the basic usage of InnoSwitch3-Pro Code Library.

- Initial commands are sent using the InnoSwitch3-Pro Initialization Routine.
- The Main Routine sets the output voltage to 5V and constant current current to 5.6A.
- Cable Drop Compensation is programmed to 300mV.
- Constant power is knee voltage is set to 7V and then Vbus Switch is turned ON

```
//Step  1  :  Add the Header Files
#include <Drv_Rtc.h>
#include <Drv_i2c.h>
#include <Inno3Pro.h>
#include <Config.h>

//Step  2  :  Create the class instance
Inno3Pro_Application Inno3ProApp;

//Step 3 :  Write Initial Commands to Inno Pro
void setup()
{
  Inno3ProApp.Inno3Pro_Initialization();
}

//Step 4 :  Call the Functions on the Main Loop
void loop()
{
      //Control Functions Set-Up

      // 5V, 5.6A , Voltage and Constant Current
      Inno3ProApp.Inno3Pro_Write_VI(5 , 5.6);

      // 300mV    , Cable Drop Compesation
      Inno3ProApp.Inno3Pro_Write_Cable_Drop_Comp(300);

      // 7V       , Constant Output Power Knee Voltage
      Inno3ProApp.Inno3Pro_Write_Volt_Peak(7);

      // ON       , Vbus Enable
      Inno3ProApp.Inno3Pro_Vbus_Switch_Control(3);
}
```


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11.2.2 I²C Drivers

I²C drivers must be correctly configured based on Arduino Wire library.

https://www.arduino.cc/en/Reference/Wire

This must be configured to meet the I²C packet format in the InnoSwitch3-Pro data sheet for Write and Read transactions. Every I²C transaction has at least a 150 us delay between commands.

11.2.2.1 I2C Write Code Example

```
void Inno3Pro_I2C::I2C_Write16(uint8_t slaveAddress, uint8_t dataAddress,
                               uint8_t *dataBuffer, uint8_t buflen)
{
    //150us Delay On Every I2C Transaction
    delayMicroseconds(150);
    Wire.beginTransmission((uint8_t)slaveAddress);

  #if ARDUINO >= 100
    Wire.write((uint8_t)dataAddress); // send address
    Wire.write((uint8_t)dataBuffer[0]);
    if(buflen == 3)
    {
        Wire.write((uint8_t)dataBuffer[1]);
    }
  #else
    Wire.send((uint8_t)dataAddress); // send address
    Wire.send((uint8_t)dataBuffer[0]);
    if(buflen == 3)
    {
        Wire.send((uint8_t)dataBuffer[1]);
    }
  #endif

  Wire.endTransmission();
}
```


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11.2.2.2 I2C Read Code Example

```
uint16_t Inno3Pro_I2C::I2C_Read16(uint8_t slaveAddress, uint8_t dataAddress)
{
    //150us Delay On Every I2C Transaction
    delayMicroseconds(150);
    uint8_t u8Lsb;                //Storage Variable for LSB Reading
    uint8_t u8Msb;                //Storage Variable for MSB Reading

 Wire.beginTransmission(slaveAddress); // start transmission to device

#if (ARDUINO >= 100)
  Wire.write(0x80);               // PI Command Address
  Wire.write(dataAddress);        // sends register address to read from
  Wire.write(dataAddress);        // sends register address to read from
#else
  Wire.send(0x80);                // PI Command Address
  Wire.send(dataAddress);         // sends register address to read from
  Wire.send(dataAddress);         // sends register address to read from
#endif
  Wire.endTransmission();         // end transmission

   //150us Delay On Every I2C Transaction
   delayMicroseconds(150);

   Wire.beginTransmission(slaveAddress); // start transmission to device
   Wire.requestFrom(slaveAddress,(uint8_t)0x02); // send data n-bytes read


#if (ARDUINO >= 100)
    //Example  5V,  Returns F4
    u8Lsb =  Wire.read();        // receive DATA

    //Example  5V,  Returns 01
    u8Msb =  Wire.read();         // receive DATA

#else
   //Example  5V,  Returns F4
    u8Lsb =  Wire.receive();         // receive DATA

    //Example  5V,  Returns 01
    u8Msb = Wire.receive();         // receive DATA


#endif

    //Wire.endTransmission();       // end transmission
    //Returns 01F4
    return ((u8Msb<<8)|(u8Lsb));
}
```


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12 Documentations

12.1 *Configurations*

This is the header file containing all the Library Macros and configuration for InnoSwitch3-Pro.

12.1.1 Macros

Firmware Revision Macro

Defines the revision number of ***InnoSwitch3-Pro Code Library*** *to track changes on each release*

Note:
Version Format: v00.00.00

- #define INNO3PRO_FW_VERSION_MAJOR '0','1'
- #define INNO3PRO_FW_VERSION_MINOR '0','2'
- #define INNO3PRO_FW_VERSION_TEST '0','0'
-

Saturation Macros

Used for Setting limits to a certain parameter

- #define sig_minmax(sig, min, max) ((sig < min) ? sig = min : (sig > max) ? sig = max : 0)
- #define sig_max(sig, max) ((sig > max) ? sig = max : 0)
- #define sig_min(sig, min) ((sig < min) ? sig = min : 0)
-

Bit Manipulation Macros

Used for Manipulating bits in a certain byte

- #define set_bit(ADDRESS, BIT) (ADDRESS |= (1<<BIT))
- #define clear_bit(ADDRESS, BIT) (ADDRESS &= ~(1<<BIT))
- #define toggle_bit(ADDRESS, BIT) (ADDRESS ^= (1<<BIT))
- #define test_bit(ADDRESS, BIT) (ADDRESS & (1<<BIT))

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InnoSwitch3-Pro I2C Macros

Defines the Slave address of InnoSwitch3-Pro and I2C Write Sizes

Note:

0011000 (0x18) - 7bit Address Scheme

- #define INNO3PRO_ADDRESS 0x18
- #define WR_WORD 0x03
- #define WR_BYTE 0x02
- #define RD_MSB 1
- #define RD_LSB 0

InnoSwitch3-Pro Read Register BitShift Count Macros

Defines the Register BitShift position used in Reading Register Values

- #define INNO3PRO_READ_OV_FAULT_BITSHIFT 14
- #define INNO3PRO_READ_UV_FAULT_BITSHIFT 12
- #define INNO3PRO_READ_CCSC_OUTPUT_SHORT_BITSHIFT 10
- #define INNO3PRO_READ_ISSC_SHORT_BITSHIFT 8
- #define INNO3PRO_READ_UVL_TIMER_BITSHIFT 6
- #define INNO3PRO_READ_WATCHDOG_TIMER_BITSHIFT 4
- #define INNO3PRO_READ_CV_MODE_BITSHIFT 2
- #define INNO3PRO_READ_CV_MODE_TIMER_BITSHIFT 0

InnoSwitch3-Pro Response and Timer Macros

Used for Response and Timer settings of registers

Note:

Use these MACROS for updating the PI Command register settings

- #define INNO3PRO_VBUS_ENABLE true
- #define INNO3PRO_VBUS_DISABLE false

- #define INNO3PRO_BLEEDER_ENABLE true
- #define INNO3PRO_BLEEDER_DISABLE false

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- #define INNO3PRO_LOAD_DISCHARGE_ENABLE true
- #define INNO3PRO_LOAD_DISCHARGE_DISABLE false

- #define INNO3PRO_TURN_OFF_PSU_ENABLE true
- #define INNO3PRO_TURN_OFF_PSU_DISABLE false
-
- #define INNO3PRO_FASTVI_UPDATE_LIMIT_ENABLE false
- #define INNO3PRO_FASTVI_UPDATE_LIMIT_DISABLE true

- #define INNO3PRO_OVL_FAULT_RESPONSE_NORESPONSE 0
- #define INNO3PRO_OVL_FAULT_RESPONSE_LATCHOFF 1
- #define INNO3PRO_OVL_FAULT_RESPONSE_AUTORESTART 2

- #define INNO3PRO_UVL_FAULT_RESPONSE_AUTORESTART 0
- #define INNO3PRO_UVL_FAULT_RESPONSE_LATCHOFF 1
- #define INNO3PRO_UVL_FAULT_RESPONSE_NORESPONSE 2

- #define INNO3PRO_CCSC_FAULT_RESPONSE_AUTORESTART 0
- #define INNO3PRO_CCSC_FAULT_RESPONSE_NORESPONSE 2

- #define INNO3PRO_ISSC_FAULT_RESPONSE_NORESPONSE 0
- #define INNO3PRO_ISSC_FAULT_RESPONSE_LATCHOFF 1
- #define INNO3PRO_ISSC_FAULT_RESPONSE_AUTORESTART 2

- #define INNO3PRO_ISSC_FREQ_THRESHOLD_50KHZ 0
- #define INNO3PRO_ISSC_FREQ_THRESHOLD_30KHZ 1
- #define INNO3PRO_ISSC_FREQ_THRESHOLD_40KHZ 2
- #define INNO3PRO_ISSC_FREQ_THRESHOLD_60KHZ 3

- #define INNO3PRO_UVL_FAULT_TIMER_8MS 0
- #define INNO3PRO_UVL_FAULT_TIMER_16MS 1
- #define INNO3PRO_UVL_FAULT_TIMER_32MS 2
- #define INNO3PRO_UVL_FAULT_TIMER_64MS 3

- #define INNO3PRO_WATCHDOG_TIMER_NOWATCHDOG 0
- #define INNO3PRO_WATCHDOG_TIMER_500MS 1
- #define INNO3PRO_WATCHDOG_TIMER_1000MS 2
- #define INNO3PRO_WATCHDOG_TIMER_2000MS 3

- #define INNO3PRO_CVOL_FAULT_RESPONSE_NORESPONSE 0
- #define INNO3PRO_CVOL_FAULT_RESPONSE_AUTORESTART 1
- #define INNO3PRO_CVOL_FAULT_RESPONSE_LATCHOFF 2

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- #define INNO3PRO_CVOL_FAULT_TIMER_8MS 0
- #define INNO3PRO_CVOL_FAULT_TIMER_16MS 1
- #define INNO3PRO_CVOL_FAULT_TIMER_32MS 2
- #define INNO3PRO_CVOL_FAULT_TIMER_64MS 3

- #define INNO3PRO_INTERRUPT_CONTROL_S_MASK 0x40
- #define INNO3PRO_INTERRUPT_BPS_CURR_LO_FAULT_MASK 0x20
- #define INNO3PRO_INTERRUPT_CVO_PKLOAD_TIMER_MASK 0x10
- #define INNO3PRO_INTERRUPT_ISSC_MASK 0x08
- #define INNO3PRO_INTERRUPT_CCSC_MASK 0x04
- #define INNO3PRO_INTERRUPT_VOUT_UV_MASK 0x02
- #define INNO3PRO_INTERRUPT_VOUT_OV_MASK 0x01

- #define INNO3PRO_OTP_FAULT_HYST_40DEG 0
- #define INNO3PRO_OTP_FAULT_HYST_60DEG 1

- #define INNO3PRO_CVLOAD_DEFAULT 0x20
- #define INNO3PRO_CVLOAD_RECOMMENDED 0x80

- #define INNO3PRO_LOOPSPEED1_DEFAULT 0x281E
- #define INNO3PRO_LOOPSPEED1_RECOMMENDED 0x140A
- #define INNO3PRO_LOOPSPEED2_DEFAULT 0x08C8
- #define INNO3PRO_LOOPSPEED2_RECOMMENDED 0x0F84

PI_COMMAND Register Address Assignments

Defines the Command Registers to Control

- #define INNO3PRO_VBEN 0x04
- #define INNO3PRO_BLEEDER 0x86
- #define INNO3PRO_VDIS 0x08
- #define INNO3PRO_TURN_OFF_PSU 0x8A
- #define INNO3PRO_FAST_VI_CMD 0x8C
- #define INNO3PRO_CVO 0x0E
- #define INNO3PRO_CV 0x10
- #define INNO3PRO_OVA 0x92
- #define INNO3PRO_UVA 0x94
- #define INNO3PRO_CDC 0x16
- #define INNO3PRO_CC 0x98
- #define INNO3PRO_CCSC 0x20
- #define INNO3PRO_VKP 0x1A
- #define INNO3PRO_OVL 0x1C

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- #define INNO3PRO_UVL 0x9E
- #define INNO3PRO_ISSC 0xA2
- #define INNO3PRO_UVL_TIMER 0xA4
- #define INNO3PRO_WATCHDOG_TIMER 0x26
- #define INNO3PRO_CVOL 0xA8
- #define INNO3PRO_CVOL_TIMER 0x2A
- #define INNO3PRO_INTERRUPT 0x2C
- #define INNO3PRO_OTP 0xAE
- #define INNO3PRO_CV_LOAD 0xB0
- #define INNO3PRO_LOOP_SPEED_1
  0x32
- #define INNO3PRO_LOOP_SPEED_2
  0x34

Telemetry(Read-Back) Register Address Assignments

Defines the Telemetry Report Back Registers to Read

- #define INNO3PRO_READ0 0x00
- #define INNO3PRO_READ1 0x02
- #define INNO3PRO_READ2 0x04
- #define INNO3PRO_READ3 0x06
- #define INNO3PRO_READ4 0x08
- #define INNO3PRO_READ5 0x0A
- #define INNO3PRO_READ6 0x0C
- #define INNO3PRO_READ7 0x0E
- #define INNO3PRO_READ9 0x12
- #define INNO3PRO_READ10 0x14
- #define INNO3PRO_READ11 0x16
- #define INNO3PRO_READ12 0x18
- #define INNO3PRO_READ13 0x1A
- #define INNO3PRO_READ14 0x1C
- #define INNO3PRO_READ15 0x5C
- #define INNO3PRO_READ_LOOP_SPEED_1 0x20
- #define INNO3PRO_READ_LOOP_SPEED_2 0x22

Telemetry READ4 Bit Assignments

Defines the Bit Assignments on READ4 Register

- #define READ4_Reg_VBEN 14

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- #define READ4_Reg_BLEEDER 13
- #define READ4_Reg_PSUOFF 12
- #define READ4_Reg_FSTVIC 11
- #define READ4_Reg_CVO 10
- #define READ4_Reg_OTP 9

Telemetry READ10 Bit Assignments

Defines the Bit Assignments on READ10 Register

- #define READ10_Reg_INTERRUPT_EN 15
- #define READ10_Reg_CONTROL_S 14
- #define READ10_Reg_VDIS 13
- #define READ10_Reg_HIGH_FSW 12
- #define READ10_Reg_OTP 9
- #define READ10_Reg_VOUT2PCT 5
- #define READ10_Reg_VOUT10PCT 4
- #define READ10_Reg_ISSC 3
- #define READ10_Reg_CCSC 2
- #define READ10_Reg_VOUT_UV 1
- #define READ10_Reg_VOUT_OV 0

Telemetry READ11 Bit Assignments

Defines the Bit Assignments on READ11 Register

- #define READ11_Reg_ar_CV 15
- #define READ11_Reg_ar_ISSC 12
- #define READ11_Reg_ar_CCSC 11
- #define READ11_Reg_ar_VOUT_OV 10
- #define READ11_Reg_ar_VOUT_UV 9
- #define READ11_Reg_LO 7
- #define READ11_Reg_Lo_CVO 6
- #define READ11_Reg_PSUOFF 5
- #define READ11_Reg_Lo_ISSC 4
- #define READ11_Reg_Lo_VOUT_OV 2
- #define READ11_Reg_Lo_VOUT_UV 1
- #define READ11_Reg_BPS_OV 0

Telemetry READ12 Bit Assignments

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Defines the Bit Assignments on READ12 Register

- #define READ12_Reg_CONTROL_S_MASK 14
- #define READ12_Reg_LO_Fault_MASK 13
- #define READ12_Reg_CCAR_MASK 12
- #define READ12_Reg_ISSC_MASK 11
- #define READ12_Reg_CCSC_MASK 10
- #define READ12_Reg_VOUT_UV_MASK 9
- #define READ12_Reg_VOUT_OV_MASK 8
- #define READ12_Reg_CONTROL_S_STATUS 6
- #define READ12_Reg_LO_FAULT_STATUS 5
- #define READ12_Reg_CCAR_STATUS 4
- #define READ12_Reg_ISSC_STATUS 3
- #define READ12_Reg_CCSC_STATUS 2
- #define READ12_Reg_VOUT_UV_STATUS 1
- #define READ12_Reg_VOUT_OV_STATUS 0

InnoSwitch3-Pro Computation Macros

Defines the constants needed for the computation of individual Registers

- #define INNO3PRO_RSENSE (float)(5.25)
- #define INNO3PRO_FULL_RANGE_RSENSE_VOLTAGE (float)(32)
- #define INNO3PRO_ADC_FULL_RANGE (float)(128)
- #define INNO3PRO_CC_SET_PT_MULT (float)((INNO3PRO_ADC_FULL_RANGE * INNO3PRO_RSENSE) / INNO3PRO_FULL_RANGE_RSENSE_VOLTAGE))
- #define INNO3PRO_CV_SET_PT_MULT (float)(100)
- #define INNO3PRO_OV_PERCENTAGE_MULT (float)(1.24)
- #define INNO3PRO_UV_PERCENTAGE_MULT (float)(0.72)
- #define INNO3PRO_OV_SET_PT_MULT (float)(10)
- #define INNO3PRO_UV_SET_PT_MULT (float)(10)
- #define INNO3PRO_CDC_SET_PT_DIV (float)(50)
- #define INNO3PRO_VKP_SET_PT_MULT (float)(10)

InnoSwitch3-Pro Sample Configuration Settings

Defines example values to be uploaded to InnoSwitch3-Pro

- #define INNO3PRO_DEFAULT_CV_SET_PT_LEVEL (float)(5)
- #define INNO3PRO_DEFAULT_OVA_SET_PT_LEVEL (float)(6.2)
- #define INNO3PRO_DEFAULT_UVA_SET_PT_LEVEL (float)(3)
- #define INNO3PRO_DEFAULT_CDC_ASSERT_LEVEL (float)(300)

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- #define INNO3PRO_DEFAULT_CC_ASSERT_LEVEL (float)(5.1)
- #define INNO3PRO_DEFAULT_VKP_ASSERT_LEVEL (float)(7)
- #define INNO3PRO_DEFAULT_VBEN_CONTROL_LOGIC (float)(0)
- #define INNO3PRO_DEFAULT_UVL_CONTROL_LOGIC (float)(0)
-
- #define INNO3PRO_5V_CV_SET_PT_LEVEL (float)(5)
- #define INNO3PRO_5V_CDC_ASSERT_LEVEL (float)(300)
- #define INNO3PRO_5V_CC_ASSERT_LEVEL (float)(5.1)
- #define INNO3PRO_5V_VKP_ASSERT_LEVEL (float)(7)
- #define INNO3PRO_5V_VBEN_CONTROL_LOGIC (float)(1)
-
- #define INNO3PRO_8V_CV_SET_PT_LEVEL (float)(8)
- #define INNO3PRO_8V_CDC_ASSERT_LEVEL (float)(300)
- #define INNO3PRO_8V_CC_ASSERT_LEVEL (float)(5.1)
- #define INNO3PRO_8V_VKP_ASSERT_LEVEL (float)(7)
- #define INNO3PRO_8V_VBEN_CONTROL_LOGIC (float)(1)
-
- #define INNO3PRO_15V_CV_SET_PT_LEVEL (float)(15)
- #define INNO3PRO_15V_CDC_ASSERT_LEVEL (float)(300)
- #define INNO3PRO_15V_CC_ASSERT_LEVEL (float)(2.76)
- #define INNO3PRO_15V_VKP_ASSERT_LEVEL (float)(7)
- #define INNO3PRO_15V_VBEN_CONTROL_LOGIC (float)(1)
-
- #define INNO3PRO_20V_CV_SET_PT_LEVEL (float)(20)
- #define INNO3PRO_20V_CDC_ASSERT_LEVEL (float)(300)
- #define INNO3PRO_20V_CC_ASSERT_LEVEL (float)(2.1)
- #define INNO3PRO_20V_VKP_ASSERT_LEVEL (float)(7)
- #define INNO3PRO_20V_VBEN_CONTROL_LOGIC (float)(1)
-
- #define INNO3PRO_3V_CV_SET_PT_LEVEL (float)(3)
- #define INNO3PRO_3V_CDC_ASSERT_LEVEL (float)(300)
- #define INNO3PRO_3V_CC_ASSERT_LEVEL (float)(5.1)
- #define INNO3PRO_3V_VKP_ASSERT_LEVEL (float)(7)
- #define INNO3PRO_3V_VBEN_CONTROL_LOGIC (float)(1)

12.1.2 Macro Definition Documentation

12.1.2.1 #define clear_bit(ADDRESS, BIT) (ADDRESS &= ~(1<<BIT))

Clear a bit in a byte

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12.1.2.2 #define INNO3PRO_15V_CC_ASSERT_LEVEL (float)(2.76)
12.1.2.3 #define INNO3PRO_15V_CDC_ASSERT_LEVEL (float)(300)
12.1.2.4 #define INNO3PRO_15V_CV_SET_PT_LEVEL (float)(15)
12.1.2.5 #define INNO3PRO_15V_VBEN_CONTROL_LOGIC (float)(1)
12.1.2.6 #define INNO3PRO_15V_VKP_ASSERT_LEVEL (float)(7)
12.1.2.7 #define INNO3PRO_20V_CC_ASSERT_LEVEL (float)(2.1)
12.1.2.8 #define INNO3PRO_20V_CDC_ASSERT_LEVEL (float)(300)
12.1.2.9 #define INNO3PRO_20V_CV_SET_PT_LEVEL (float)(20)
12.1.2.10 #define INNO3PRO_20V_VBEN_CONTROL_LOGIC (float)(1)
12.1.2.11 #define INNO3PRO_20V_VKP_ASSERT_LEVEL (float)(7)
12.1.2.12 #define INNO3PRO_3V_CC_ASSERT_LEVEL (float)(5.1)
12.1.2.13 #define INNO3PRO_3V_CDC_ASSERT_LEVEL (float)(300)
12.1.2.14 #define INNO3PRO_3V_CV_SET_PT_LEVEL (float)(3)
12.1.2.15 #define INNO3PRO_3V_VBEN_CONTROL_LOGIC (float)(1)
12.1.2.16 #define INNO3PRO_3V_VKP_ASSERT_LEVEL (float)(7)
12.1.2.17 #define INNO3PRO_5V_CC_ASSERT_LEVEL (float)(5.1)
12.1.2.18 #define INNO3PRO_5V_CDC_ASSERT_LEVEL (float)(300)
12.1.2.19 #define INNO3PRO_5V_CV_SET_PT_LEVEL (float)(5)
12.1.2.20 #define INNO3PRO_5V_VBEN_CONTROL_LOGIC (float)(1)
12.1.2.21 #define INNO3PRO_5V_VKP_ASSERT_LEVEL (float)(7)
12.1.2.22 #define INNO3PRO_8V_CC_ASSERT_LEVEL (float)(5.1)

12.1.2.23 #define INNO3PRO_8V_CDC_ASSERT_LEVEL (float)(300)
12.1.2.24 #define INNO3PRO_8V_CV_SET_PT_LEVEL (float)(8)
12.1.2.25 #define INNO3PRO_8V_VBEN_CONTROL_LOGIC (float)(1)
12.1.2.26 #define INNO3PRO_8V_VKP_ASSERT_LEVEL (float)(7)
12.1.2.27 #define INNO3PRO_ADC_FULL_RANGE (float)(128)

Analog to Digital Full Range

12.1.2.28 #define INNO3PRO_ADDRESS 0x18

InnoSwitch3-Pro I2C 7-bit Slave Address

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12.1.2.29 #define INNO3PRO_BLEEDER 0x86

Activate Bleeder(Vout) Function Register

12.1.2.30 #define INNO3PRO_BLEEDER_DISABLE false

Active Bleeder Disable

12.1.2.31 #define INNO3PRO_BLEEDER_ENABLE true

Active Bleeder Enable

12.1.2.32 #define INNO3PRO_CC 0x98

Constant Current Regulation Register

12.1.2.33 #define
INNO3PRO_CC_SET_PT_MULT (float)((INNO3PRO_ADC_FULL_RANGE * INNO3PRO_RSENSE) / INNO3PRO_FULL_RANGE_RSENSE_VOLTAGE)

CC Set Point Computation: (Value * Rsense * 128 / 32)

12.1.2.34 #define INNO3PRO_CCSC 0x20

Output Short-Circuit Fault Detection Register

12.1.2.35 #define INNO3PRO_CCSC_FAULT_RESPONSE_AUTORESTART 0

Output Short Circuit Fault Response Set to Auto-Restart

12.1.2.36 #define INNO3PRO_CCSC_FAULT_RESPONSE_NORESPONSE 2

Output Shor Circuit Fault Response Set to No-Response

12.1.2.37 #define INNO3PRO_CDC 0x16

Cable Drop Compensation Register

12.1.2.38 #define INNO3PRO_CDC_SET_PT_DIV (float)(50)

Divider for Cable Drop Compensation Step Size of 50mv/LSB

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12.1.2.39 #define INNO3PRO_CV 0x10
Output Voltage Register

12.1.2.40 #define INNO3PRO_CV_LOAD 0xB0
Constant Voltage Load

12.1.2.41 #define INNO3PRO_CV_SET_PT_MULT (float)(100)
Multiplier for Output Voltage Step Size of 10mv/LSB

12.1.2.42 #define INNO3PRO_CVLOAD_DEFAULT 0x20
Constant Voltage Load Default Settings

12.1.2.43 #define INNO3PRO_CVLOAD_RECOMMENDED 0x80
Constant Voltage Load Recommended Settings

12.1.2.44 #define INNO3PRO_CVO 0x0E
Constant Voltage Only Register

12.1.2.45 #define INNO3PRO_CVOL 0xA8
Constant Voltage Mode Fault Response Register

12.1.2.46 #define INNO3PRO_CVOL_FAULT_RESPONSE_AUTORESTART 1
Constant Voltage Only Fault Response Set to Auto-Restart

12.1.2.47 #define INNO3PRO_CVOL_FAULT_RESPONSE_LATCHOFF 2
Constant Voltage Only Fault Response Set to Latch-Off

12.1.2.48 #define INNO3PRO_CVOL_FAULT_RESPONSE_NORESPONSE 0
Constant Voltage Only Fault Response Set to No Response

12.1.2.49 #define INNO3PRO_CVOL_FAULT_TIMER_16MS 1
Constant Voltage Only Fault Timer Set to 16ms

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12.1.2.50 #define INNO3PRO_CVOL_FAULT_TIMER_32MS 2
Constant Voltage Only Fault Timer Set to 32ms

12.1.2.51 #define INNO3PRO_CVOL_FAULT_TIMER_64MS 3
Constant Voltage Only Fault Timer Set to 64ms

12.1.2.52 #define INNO3PRO_CVOL_FAULT_TIMER_8MS 0
Constant Voltage Only Fault Timer Set to 8ms

12.1.2.53 #define INNO3PRO_CVOL_TIMER 0x2A
Constant Voltage Fault Timer Register

12.1.2.54 #define INNO3PRO_DEFAULT_CC_ASSERT_LEVEL (float)(5.1)
12.1.2.55 #define INNO3PRO_DEFAULT_CDC_ASSERT_LEVEL (float)(300)
12.1.2.56 #define INNO3PRO_DEFAULT_CV_SET_PT_LEVEL (float)(5)
12.1.2.57 #define INNO3PRO_DEFAULT_OVA_SET_PT_LEVEL (float)(6.2)
12.1.2.58 #define INNO3PRO_DEFAULT_UVA_SET_PT_LEVEL (float)(3)
12.1.2.59 #define INNO3PRO_DEFAULT_UVL_CONTROL_LOGIC (float)(0)
12.1.2.60 #define INNO3PRO_DEFAULT_VBEN_CONTROL_LOGIC (float)(0)
12.1.2.61 #define INNO3PRO_DEFAULT_VKP_ASSERT_LEVEL (float)(7).

12.1.2.62 #define INNO3PRO_FAST_VI_CMD 0x8C
Speed of Output CV/CC Update Register

12.1.2.63 #define INNO3PRO_FASTVI_UPDATE_LIMIT_DISABLE true
Fast VI Command Disable

12.1.2.64 #define INNO3PRO_FASTVI_UPDATE_LIMIT_ENABLE false
Fast VI Command Enable

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12.1.2.65 #define INNO3PRO_FULL_RANGE_RSENSE_VOLTAGE (float)(32)
Current Sense Resistor Full Range Voltage in mV

12.1.2.66 #define INNO3PRO_FW_VERSION_MAJOR '0','1'
Firmware Version for Major Code Changes

12.1.2.67 #define INNO3PRO_FW_VERSION_MINOR '0','2'
Firmware Version for Minor Code Changes

12.1.2.68 #define INNO3PRO_FW_VERSION_TEST '0','0'
Firmware Version for Test Codes

12.1.2.69 #define INNO3PRO_INTERRUPT 0x2C
Interrupt Mask Register

12.1.2.70 #define INNO3PRO_INTERRUPT_BPS_CURR_LO_FAULT_MASK 0x20
Interrupt Mask for BPS Current Latch-off Fault

12.1.2.71 #define INNO3PRO_INTERRUPT_CONTROL_S_MASK 0x40
Interrupt Mask for Control Secondary Fault

12.1.2.72 #define INNO3PRO_INTERRUPT_CVO_PKLOAD_TIMER_MASK 0x10
Interrupt Mask for CVO Mode Peak Load Timer Fault

12.1.2.73 #define INNO3PRO_INTERRUPT_ISSC_MASK 0x08
Interrupt Mask for IS-Pin Short Fault

12.1.2.74 #define INNO3PRO_INTERRUPT_CCSC_MASK 0x04
Interrupt mask for Output Short Circuit Fault

12.1.2.75 #define INNO3PRO_INTERRUPT_VOUT_OV_MASK 0x01
Interrupt Mask for Overvoltage Fault

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12.1.2.76 #define INNO3PRO_INTERRUPT_VOUT_UV_MASK 0x02

Interrupt Mask for Undervoltage Fault

12.1.2.77 #define INNO3PRO_ISSC 0xA2

IS-Pin Short Fault Response and Detection Frequency Register

12.1.2.78 #define INNO3PRO_ISSC_FAULT_RESPONSE_AUTORESTART 2

IS-Pin Short Fault Response Set to Auto-Restart

12.1.2.79 #define INNO3PRO_ISSC_FAULT_RESPONSE_LATCHOFF 1

IS-Pin Short Fault Response Set to Latch-Off

12.1.2.80 #define INNO3PRO_ISSC_FAULT_RESPONSE_NORESPONSE 0

IS-Pin Short Fault Response Set to No Response

12.1.2.81 #define INNO3PRO_ISSC_FREQ_THRESHOLD_30KHZ 1

IS-Pin Short Frequency Detection Threshold at 30Khz

12.1.2.82 #define INNO3PRO_ISSC_FREQ_THRESHOLD_40KHZ 2

IS-Pin Short Frequency Detection Threshold at 40Khz

12.1.2.83 #define INNO3PRO_ISSC_FREQ_THRESHOLD_50KHZ 0

IS-Pin Short Frequency Detection Threshold at 50Khz

12.1.2.84 #define INNO3PRO_ISSC_FREQ_THRESHOLD_60KHZ 3

IS-Pin Short Frequency Detection Threshold at 60Khz

12.1.2.85 #define INNO3PRO_LOAD_DISCHARGE_DISABLE false

Load Discharge Enable

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12.1.2.86 #define INNO3PRO_LOAD_DISCHARGE_ENABLE true
Load Discharge Enable

12.1.2.87 #define INNO3PRO_LOOP_SPEED_1 0x32
Loop Speed 1

12.1.2.88 #define INNO3PRO_LOOP_SPEED_2 0x34
Loop Speed 2

12.1.2.89 #define INNO3PRO_LOOPSPEED1_DEFAULT 0x281E
Loop Speed 1 Default Settings

12.1.2.90 #define INNO3PRO_LOOPSPEED1_RECOMMENDED 0x140A
Loop Speed 1 Recommended Settings

12.1.2.91 #define INNO3PRO_LOOPSPEED2_DEFAULT 0x08C8
Loop Speed 2 Default Settings

12.1.2.92 #define INNO3PRO_LOOPSPEED2_RECOMMENDED 0x0F84
Loop Speed 2 Recommended Settings

12.1.2.93 #define INNO3PRO_OTP 0xAE
Secondary Over-Temperature Fault Hysteresis Register

12.1.2.94 #define INNO3PRO_OTP_FAULT_HYST_40DEG 0
Over Temperature Fault Hysteresis Set to 40 Degrees Celsius

12.1.2.95 #define INNO3PRO_OTP_FAULT_HYST_60DEG 1
Over Temperature Fault Hysteresis Set to 60 Degrees Celsius

12.1.2.96 #define INNO3PRO_OV_PERCENTAGE_MULT (float)(1.24)
Percentage Setting: 124% of CV

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12.1.2.97 #define INNO3PRO_OV_SET_PT_MULT (float)(10)

Multiplier for OverVoltage Step Size of 100mv/LSB

12.1.2.98 #define INNO3PRO_OVA 0x92

Over-Voltage Threshold Register

12.1.2.99 #define INNO3PRO_OVL 0x1C

Over Voltage Fault Response Register

12.1.2.100 #define INNO3PRO_OVL_FAULT_RESPONSE_AUTORESTART 2

Overvoltage Fault Response Set to Auto-Restart

12.1.2.101 #define INNO3PRO_OVL_FAULT_RESPONSE_LATCHOFF 1

Overvoltage Fault Response Set to Latch-Off

12.1.2.102 #define INNO3PRO_OVL_FAULT_RESPONSE_NORESPONSE 0

Overvoltage Fault Response Set to No Response

12.1.2.103 #define INNO3PRO_READ0 0x00

Revision ID Telemetry Register

12.1.2.104 #define INNO3PRO_READ1 0x02

Output Voltage Set-Point Telemetry Register

12.1.2.105 #define INNO3PRO_READ10 0x14

INNTERRUPT,CONTROL_S,VDIS,HIGH_FSW,OTP,VOUT2PCT,VOUT10PCT, ISSC, CCSC VOUT_UV,VOUT_OV Telemetry Register

12.1.2.106 #define INNO3PRO_READ11 0x16

AR_CVO,AR_ISSC,CCSC,VOUT_OV,VOUT_UV,LO,LO_CVO,PSU_OFF,LO_ISSC, LO_CCSC,LO_VOUT_OV, LO_VOUT_UV, BPS_OV Telemetry Register

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12.1.2.107 #define INNO3PRO_READ12 0x18

Interrupts Telemetry Register

12.1.2.108 #define INNO3PRO_READ13 0x1A

Average Measured Output Current Telemetry Register

12.1.2.109 #define INNO3PRO_READ14 0x1C

Average Measured Output Voltage Telemetry Register

12.1.2.110 #define INNO3PRO_READ15 0x5C

Voltage DAC Telemetry Register

12.1.2.111 #define INNO3PRO_READ2 0x04

Under-Voltage Threshold Telemetry Register

12.1.2.112 #define INNO3PRO_READ3 0x06

Over-Voltage Threshold Telemetry Register

12.1.2.113 #define INNO3PRO_READ4 0x08

VBEN,BLEEDER,PSUOFF,FSTVIC,CVO,OTP,CDC Telemetry Register

12.1.2.114 #define INNO3PRO_READ5 0x0A

Constant Current , Constant Power Telemetry Register

12.1.2.115 #define INNO3PRO_READ6 0x0C

OVL,UVL,CCSL,ISSC,UVLTIMER,WDTIMER,CVMODE,CVTIMER Telemetry Register

12.1.2.116 #define INNO3PRO_READ7 0x0E

Measured Output Current Telemetry Register

12.1.2.117 #define INNO3PRO_READ9 0x12

Measured Output Voltage Telemetry Register

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12.1.2.118 #define INNO3PRO_READ_CCSC_OUTPUT_SHORT_BITSHIFT 10
Output Short Circuit Bit Shift Count

12.1.2.119 #define INNO3PRO_READ_CV_MODE_BITSHIFT 2
Constant Voltage Only Mode Bit Shift Count

12.1.2.120 #define INNO3PRO_READ_CV_MODE_TIMER_BITSHIFT 0
Constant Voltage Only Mode Timer Bit Shift Count

12.1.2.121 #define INNO3PRO_READ_ISSC_SHORT_BITSHIFT 8
IS-Pin Short Fault Bit Shift Count

12.1.2.122 #define INNO3PRO_READ_LOOP_SPEED_1 0x20
Loop Speed 1 Telemetry Register

12.1.2.123 #define INNO3PRO_READ_LOOP_SPEED_2 0x22
Loop Speed 2 Telemetry Register

12.1.2.124 #define INNO3PRO_READ_OV_FAULT_BITSHIFT 14
Overvoltage Fault Bit Shift Count

12.1.2.125 #define INNO3PRO_READ_UV_FAULT_BITSHIFT 12
Undervoltage Fault Bit Shift Count

12.1.2.126 #define INNO3PRO_READ_UVL_TIMER_BITSHIFT 6
Undervoltage Fault Timer Bit Shift Count

12.1.2.127 #define INNO3PRO_READ_WATCHDOG_TIMER_BITSHIFT 4
Watchdog Timer Bit Shift Count

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12.1.2.128 #define INNO3PRO_RSENSE (float)(5.25)
Current Sense Resistor in milli Ohm

12.1.2.129 #define INNO3PRO_TURN_OFF_PSU 0x8A
Latch-off Device Register

12.1.2.130 #define INNO3PRO_TURN_OFF_PSU_DISABLE false
Latch Off Device Disable

12.1.2.131 #define INNO3PRO_TURN_OFF_PSU_ENABLE true
Latch Off Device Enable

12.1.2.132 #define INNO3PRO_UV_PERCENTAGE_MULT (float)(0.72)
Percentage Setting: 72% of CV

12.1.2.133 #define INNO3PRO_UV_SET_PT_MULT (float)(10)
Multiplier for UnderVoltage Step Size of 100mv/LSB

12.1.2.134 #define INNO3PRO_UVA 0x94
Under-Voltage Threshold Register

12.1.2.135 #define INNO3PRO_UVL 0x9E
Under Voltage Fault Response Register

12.1.2.136 #define INNO3PRO_UVL_FAULT_RESPONSE_AUTORESTART 0
Undervoltage Fault Response Set to Auto-Restart

12.1.2.137 #define INNO3PRO_UVL_FAULT_RESPONSE_LATCHOFF 1
Undervoltage Fault Response Set to Latch-Off

12.1.2.138 #define INNO3PRO_UVL_FAULT_RESPONSE_NORESPONSE 2
Undervoltage Fault Response Set to No Response

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12.1.2.139 #define INNO3PRO_UVL_FAULT_TIMER_16MS 1
Undervoltage Fault Timer Set to 16ms

12.1.2.140 #define INNO3PRO_UVL_FAULT_TIMER_32MS 2
Undervoltage Fault Timer Set to 32ms

12.1.2.141 #define INNO3PRO_UVL_FAULT_TIMER_64MS 3
Undervoltage Fault Timer Set to 64ms

12.1.2.142 #define INNO3PRO_UVL_FAULT_TIMER_8MS 0
Undervoltage Fault Timer Set to 8ms

12.1.2.143 #define INNO3PRO_UVL_TIMER 0xA4
UVL Fault Timer Register

12.1.2.144 #define INNO3PRO_VBEN 0x04
Series Bus Switch Control Register

12.1.2.145 #define INNO3PRO_VBUS_DISABLE false
Series Bus Switch Disable

12.1.2.146 #define INNO3PRO_VBUS_ENABLE true
Series Bus Switch Enable

12.1.2.147 #define INNO3PRO_VDIS 0x08
Load (VBUS) Discharge Register

12.1.2.148 #define INNO3PRO_VKP 0x1A
Constant Output Power Knee Voltage Register

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12.1.2.149 #define INNO3PRO_VKP_SET_PT_MULT (float)(10)
Multiplier for Constant Output Power Knee Voltage Step Size of 100mv/LSB

12.1.2.150 #define INNO3PRO_WATCHDOG_TIMER 0x26
Communication Rate Monitor Register

12.1.2.151 #define INNO3PRO_WATCHDOG_TIMER_1000MS 2
Watchdog Timer Set to 1 sec

12.1.2.152 #define INNO3PRO_WATCHDOG_TIMER_2000MS 3
Watchdog Timer Set to 2 sec

12.1.2.153 #define INNO3PRO_WATCHDOG_TIMER_500MS 1
Watchdog Timer Set to 0.5 sec

12.1.2.154 #define INNO3PRO_WATCHDOG_TIMER_NOWATCHDOG 0
Watchdog Timer Set to 0 sec (No-Watchdog)

12.1.2.155 #define RD_LSB 0
InnoSwitch3-Pro Read LSB

12.1.2.156 #define RD_MSB 1
InnoSwitch3-Pro Read MSB

12.1.2.157 #define READ10_Reg_CCSC 2
Output Short Circuit Detected

12.1.2.158 #define READ10_Reg_CONTROL_S 14
System Ready Signal

12.1.2.159 #define READ10_Reg_HIGH_FSW 12
Switching Frequency High?

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12.1.2.160 #define READ10_Reg_INTERRUPT_EN 15
Interrupt Enable

12.1.2.161 #define READ10_Reg_ISSC 3
IS-pin Short Circuit Detected

12.1.2.162 #define READ10_Reg_OTP 9
Over Temperature Protection

12.1.2.163 #define READ10_Reg_VDIS 13
Output Discharge

12.1.2.164 #define READ10_Reg_VOUT10PCT 4
VOUTADC > 1.1*Vout

12.1.2.165 #define READ10_Reg_VOUT2PCT 5
2% Bleeder Enabled

12.1.2.166 #define READ10_Reg_VOUT_OV 0
Output Voltage OV Fault

12.1.2.167 #define READ10_Reg_VOUT_UV 1
Output Voltage UV Fault

12.1.2.168 #define READ11_Reg_ar_CCSC 11
Output Short-Circuit AR

12.1.2.169 #define READ11_Reg_ar_CV 15
CVO Mode AR

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12.1.2.170 #define READ11_Reg_ar_ISSC 12
IS-pin Short Circuit AR

12.1.2.171 #define READ11_Reg_ar_VOUT_OV 10
Output Voltage OV AR

12.1.2.172 #define READ11_Reg_ar_VOUT_UV 9
Output Voltage UV AR

12.1.2.173 #define READ11_Reg_BPS_OV 0
BPS-pin LO

12.1.2.174 #define READ11_Reg_LO 7
Latch-Off (LO) Occurred

12.1.2.175 #define READ11_Reg_Lo_CVO 6
CVO Mode LO

12.1.2.176 #define READ11_Reg_Lo_ISSC 4
IS-pin Short Circuit LO

12.1.2.177 #define READ11_Reg_Lo_VOUT_OV 2
Output Voltage OV LO

12.1.2.178 #define READ11_Reg_Lo_VOUT_UV 1
Output Voltage UV LO

12.1.2.179 #define READ11_Reg_PSUOFF 5
PSU Turn-Off CMD Received

12.1.2.180 #define READ12_Reg_CCAR_MASK 12
Interrupts Masks

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12.1.2.181 #define READ12_Reg_CCAR_STATUS 4
Interrupts Status

12.1.2.182 #define READ12_Reg_CCSC_MASK 10
Interrupt Masks

12.1.2.183 #define READ12_Reg_CCSC_STATUS 2
Interrupt Status

12.1.2.184 #define READ12_Reg_CONTROL_S_MASK 14
Interrupts Masks

12.1.2.185 #define READ12_Reg_CONTROL_S_STATUS 6
Interrupts Status

12.1.2.186 #define READ12_Reg_ISSC_MASK 11
Interrupts Masks

12.1.2.187 #define READ12_Reg_ISSC_STATUS 3
Interrupts Status

12.1.2.188 #define READ12_Reg_LO_Fault_MASK 13
Interrupts Masks

12.1.2.189 #define READ12_Reg_LO_FAULT_STATUS 5
Interrupts Status

12.1.2.190 #define READ12_Reg_VOUT_OV_MASK 8
Interrupts Masks

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12.1.2.191 #define READ12_Reg_VOUT_OV_STATUS 0
Interrupts Status

12.1.2.192 #define READ12_Reg_VOUT_UV_MASK 9
Interrupts Masks

12.1.2.193 #define READ12_Reg_VOUT_UV_STATUS 1
Interrupts Status

12.1.2.194 #define READ4_Reg_BLEEDER 13
Minimum Load

12.1.2.195 #define READ4_Reg_CVO 10
Constant-Voltage Mode Only

12.1.2.196 #define READ4_Reg_FSTVIC 11
Fast VI Commands

12.1.2.197 #define READ4_Reg_OTP 9
Over-Temperature Protection

12.1.2.198 #define READ4_Reg_PSUOFF 12
Turn PSU Off

12.1.2.199 #define READ4_Reg_VBEN 14
VBUS Switch Enable

12.1.2.200 #define set_bit(ADDRESS, BIT) (ADDRESS |= (1<<BIT))
Set a bit in a byte

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12.1.2.201 #define sig_max(sig, max) ((sig > max) ? sig = max : 0)

Constrain the parameter up to Minimum Value Only

12.1.2.202 #define sig_min(sig, min) ((sig < min) ? sig = min : 0)

Constrain the parameter up to Maximum Value Only

12.1.2.203 #define sig_minmax(sig, min, max) ((sig < min) ? sig = min : (sig > max) ? sig = max : 0)

Constrain the parameter up to Minimum and Maximum Value Only

12.1.2.204 #define test_bit(ADDRESS, BIT) (ADDRESS & (1<<BIT))

Test a bit in a byte if it Set

12.1.2.205 #define toggle_bit(ADDRESS, BIT) (ADDRESS ^= (1<<BIT))

Toggle a bit in a byte

12.1.2.206 #define WR_BYTE 0x02

InnoSwitch3-Pro I2C Buffer Length (Address, LSB)

12.1.2.207 #define WR_WORD 0x03

InnoSwitch3-Pro I2C Buffer Length (Address, LSB, MSB)

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12.2 *I2C Drivers*

This is the source file containing the driver APIs for I2C.

12.2.1 Functions

- int I2C_Write16 (uint16_t slaveAddress, uint8_t dataAddress, uint8_t *dataBuffer, uint8_t buflen)
  Handles one i2c master write transaction with the supplied parameters.

- uint16_t I2C_Read16 (uint16_t slaveAddress, uint8_t dataAddress)
  Handles one i2c master read transaction with the supplied parameters.

- uint8_t I2C_Read8 (uint16_t slaveAddress, uint8_t dataAddress)
  Handles one i2c master write transaction with the supplied parameters.

12.2.2 Function Documentation

12.2.2.1 int I2C_Write16 (uint16_t slaveAddress, uint8_t dataAddress, uint8_t * dataBuffer, uint8_t buflen)

Handles one i2c master write transaction with the supplied parameters.

This Writes 1 to 2 Bytes of data to the Slave Device

Parameters:

slaveAddress	- The address of the i2c Device to be accessed Uses 7 Bit Address Scheme
dataAddress	- The Register Address to be accessed
dataBuffer	- A pointer to the block of data to be sent
buflen	- The length of the data block to be sent

Returns:

None

12.2.2.2 uint16_t I2C_Read16 (uint16_t slaveAddress, uint8_t dataAddress)

Handles one i2c master read transaction with the supplied parameters.

This Reads 2 Bytes of data from the Slave Device

Parameters:

slaveAddress	- The address of the i2c Device to be accessed Uses 7 Bit Address Scheme
dataAddress	- The Register Address to be accessed

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Returns:
Merged LSB and MSB from the Slave Device

12.2.2.3 uint8_t I2C_Read8(uint16_t slaveAddress, uint8_t dataAddress)

Handles one i2c master read transaction with the supplied parameters.
This Reads 1 Byte of data from the Slave Device

Parameters:

slaveAddress	- The address of the i2c Device to be accessed Uses 7 Bit Address Scheme
dataAddress	- The Register Address to be accessed

Returns:
1Byte of Data from the Slave Device

12.3 ***Clock Driver***

This is the source file containing the driver APIs for Clock Signals.

12.3.1 Functions

- void clock_TimeUpdate (void)
  This a Simple clock interface that must run on an interrupt to generate clock signals (milli seconds, Seconds) which are used to create delays based on the system clock.

- uint16_t clock_GetElapsedTimeUs (uint16_t u16TimeStamp)
  Used for calculating the elapsed time in micro seconds.

- uint16_t clock_GetElapsedTimeMs (uint16_t u16TimeStamp)
  Used for calculating the elapsed time in milli seconds.

- uint16_t clock_GetElapsedTimeSec (uint16_t u16TimeStamp)
  Used for calculating the elapsed time in seconds.

- uint16_t clock_GetTimeStampUs (void)
  Get the current timestamp in uSec.

- uint16_t clock_GetTimeStampMs (void)
  Get the current timestamp in mSec.

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- uint16_t clock_GetTimeStampSec (void)
  Get the current timestamp in Sec.

- bool clock_HasTimeElapsedUs (uint16_t u16TimeStamp, uint16_t u16TimeDurationCheck)
  Used for Generating micro Seconds delay.

- bool clock_HasTimeElapsedMs (uint16_t u16TimeStamp, uint16_t u16TimeDurationCheck)
  Used for Generating milli Seconds delay.

- bool clock_HasTimeElapsedSec (uint16_t u16TimeStamp, uint16_t u16TimeDurationCheck)
  Used for Generating Seconds delay.

12.3.2 Function Documentation

12.3.2.1 uint16_t clock_GetElapsedTimeMs (uint16_t u16TimeStamp)[inline]

Used for calculating the elapsed time in milli seconds.

Parameters:

u16TimeStamp	- milli second time stamp variable

Returns:

Returns the Time that have elapsed since u16TimeStamp

12.3.2.2 uint16_t clock_GetElapsedTimeSec (uint16_t u16TimeStamp)[inline]

Used for calculating the elapsed time in seconds.

Parameters:

u16TimeStamp	- second time stamp variable

Returns:

Returns the Time that have elapsed since u16TimeStamp

12.3.2.3 uint16_t clock_GetElapsedTimeUs (uint16_t u16TimeStamp)[inline]

Used for calculating the elapsed time in micro seconds.

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Parameters:

u16TimeStamp	- micro second time stamp variable

Returns:

Returns the Time that have elapsed since u16TimeStamp

12.3.2.4 uint16_t clock_GetTimeStampMs (void)[inline]

Get the current timestamp in mSec.

Parameters:

None	

Returns:

Current timestamp in milli Seconds

12.3.2.5 uint16_t clock_GetTimeStampSec (void)[inline]

Get the current timestamp in Sec.

Parameters:

None	

Returns:

Current timestamp in Seconds

12.3.2.6 uint16_t clock_GetTimeStampUs (void)[inline]

Get the current timestamp in uSec.

Parameters:

None	

Returns:

Current timestamp in micro Seconds

12.3.2.7 bool clock_HasTimeElapsedMs (uint16_t u16TimeStamp, uint16_t u16TimeDurationCheck)[inline]

Used for Generating milli Seconds delay.

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Parameters:

u16TimeStamp	- milli second time stamp variable
u16TimeDurationCheck	- Duration to compare against the TimeStamp

Returns:

TRUE after Delay Time has Elapsed

12.3.2.8 bool clock_HasTimeElapsedSec (uint16_t u16TimeStamp, uint16_t u16TimeDurationCheck)[inline]

Used for Generating Seconds delay.

Parameters:

u16TimeStamp	- second time stamp variable
u16TimeDurationCheck	- Duration to compare against the TimeStamp

Returns:

TRUE after Delay Time has Elapsed

12.3.2.9 bool clock_HasTimeElapsedUs (uint16_t u16TimeStamp, uint16_t u16TimeDurationCheck)[inline]

Used for Generating micro Seconds delay.

Parameters:

u16TimeStamp	- micro second time stamp variable
u16TimeDurationCheck	- Duration to compare against the TimeStamp

Returns:

TRUE after Delay Time has Elapsed

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12.3.2.10 void clock_TimeUpdate (void)

This a Simple clock interface that must run on an interrupt to generate clock signals (milli seconds, Seconds) which are used to create delays based on the system clock.

This is somehow similar to generation of Arduino millis() function.

Note:

This function must run on a 200us interrupt.

Parameters:

None	

Returns:

None

12.4 *InnoSwitch3-Pro*

12.4.1 Functions

This is the source file containing the InnoSwitch3-Pro APIs.

Setter Functions

Functions for Setting the values of the Register Variables

- void Inno3Pro_Set_Register_CV (float fVout)
- void Inno3Pro_Set_Register_OVA (float fOva)
- void Inno3Pro_Set_Register_UVA (float fUva)
- void Inno3Pro_Set_Register_CC (float fCc)
- void Inno3Pro_Set_Register_CDC (float fCdc)
- void Inno3Pro_Set_Register_VKP (float fVkp)
- void Inno3Pro_Set_Register_VBEN (float fVben)
- void Inno3Pro_Set_Register_UVL (float fUvl)
- void Inno3Pro_Set_Rsense_Value (float fRsense)

Getter Functions

Functions for Getting the contents of the Register Variables

- float Inno3Pro_Get_Register_CV (void)
- float Inno3Pro_Get_Register_OVA (void)
- float Inno3Pro_Get_Register_UVA (void)
- float Inno3Pro_Get_Register_CC (void)
- float Inno3Pro_Get_Register_CDC (void)
- float Inno3Pro_Get_Register_VKP (void)
- float Inno3Pro_Get_Register_VBEN (void)

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- float Inno3Pro_Get_Register_UVL (void)
- float Inno3Pro_Get_Rsense_Value (void)

Computation Functions

Threshold Calculations and Adjustment Range for specific Registers

- float Inno3Pro_Compute_CV (float fSetPt)

InnoSwitch3-Pro Computation for Output Voltage (CV)

- float Inno3Pro_Compute_OV (float fSetPt)

InnoSwitch3-Pro Computation for Over-Voltage Threshold (OVA)

- float Inno3Pro_Compute_UV (float fSetPt)

InnoSwitch3-Pro Computation for Under-Voltage Threshold (UVA)

- float Inno3Pro_Compute_CDC (float fSetPt)

InnoSwitch3-Pro Computation for Cable Drop Compensation (CDC)

- float Inno3Pro_Compute_CC (float fSetPt)

InnoSwitch3-Pro Computation for Constant Current Regulation (CC)

- float Inno3Pro_Compute_VKP (float fSetPt)

InnoSwitch3-Pro Computation for Output Power Knee Voltage (VKP)

- float Inno3Pro_Compute_VBEN (float fSetPt)

InnoSwitch3-Pro Computation for Series Bus Switch Control (VBEN)

Buffer Related Functions

Buffer and Parity Handling

- void Inno3Pro_Encode_Buffer (uint16_t u16Temp, uint8_t *u8WriteBuffer)

InnoSwitch3-Pro Conversion for I2C buffers.

- void Inno3Pro_Encode_Buffer_Parity (uint16_t u16Temp, uint8_t *u8WriteBuffer)

InnoSwitch3-Pro Conversion for I2C buffers.

- bool Inno3Pro_OddParity (uint8_t u8OddParity)

InnoSwitch3-Pro Odd Parity Bit Detection.

- void Inno3Pro_Process_Volt_Buffers (void)

Handles Preparation for values to be written on InnoSwitch3-Pro Voltage Related Registers.

Request Detection Functions

Stores the Previous value of the Register Variables

- bool Inno3Pro_Detect_Voltage_Request (void)

Checks if there's a new Voltage Request.

- bool Inno3Pro_Detect_Current_Request (void)

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Checks if there's a new Current Request.

API Write Functions

Application Programming Interface to control InnoSwitch3-Pro

- void Inno3Pro_Initialization (void)

Handles all Common I2C Configurations to be written to InnoSwitch3-Pro as initialization.

- void Inno3Pro_Vbus_Switch_Control (bool bEnableVben)

Vbus Switch Control (VBEN Control)

- void Inno3Pro_Bleeder_Enable (bool bEnable)

Handles Bleeder Setting.

- void Inno3Pro_Load_Discharge (bool bEnable)

Activates Vbus Load Discharge.

- void Inno3Pro_TurnOff_PSU (bool bEnable)

Turns off the power supply.

- void Inno3Pro_FastVI_Disable (bool bDisable)

CV and CC Commands speed limit.

- void Inno3Pro_CVOnlyMode_Enable (bool bEnable)

Constant voltage only mode.

- void Inno3Pro_Write_Volts (float fSetPtCV)

Output Voltage Control without Bleeder Control.

- void Inno3Pro_Write_Over_Volts (float fSetPtOVA)

Over Voltage Protection.

- void Inno3Pro_Write_Under_Volts (float fSetPtUVA)

Under Voltage Protection.

- void Inno3Pro_Write_Cable_Drop_Comp (float fSetPtCDC)

Cable Drop Compensation (CDC) Control.

- void Inno3Pro_Write_Amps (float fSetPtCC)

Constant Current (CC) Control.

- void Inno3Pro_Write_Volt_Peak (float fSetPtVpk)

Constant Output Power Voltage Threshold (VKP) Control.

- void Inno3Pro_Write_OVL_Fault_Response (uint16_t u16Response)

Over Voltage Fault Response Setting.

- void Inno3Pro_Write_UVL_Fault_Response (uint16_t u16Response)

Under Voltage Fault Response Setting.

- void Inno3Pro_Write_CCSC_Fault_Response (uint16_t u16Response)

Under Voltage Fault Response Setting.

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- void Inno3Pro_Write_ISSC_Fault_Response (uint16_t u16Response, uint16_t u16Frequency)

IS Pin Short Fault Response Setting.

- void Inno3Pro_Write_UVL_Fault_Timer (uint16_t u16Timer)

Under Voltage Fault Timer Setting.

- void Inno3Pro_Write_Watchdog_Timer (uint16_t u16Timer)

Watchdog Timer Setting.

- void Inno3Pro_Write_CVOL_Fault_Response (uint16_t u16Response)

CV Only Fault Response Setting.

- void Inno3Pro_Write_CVOL_Fault_Timer (uint16_t u16Timer)

CV Only Fault Timer Setting.

- void Inno3Pro_Write_Interupt_Mask (uint16_t u16IntMask)

Interrupt Mask Setting.

- void Inno3Pro_Write_OTP_Hysteresis (uint16_t u16Otp)

Over Temperature Setting.

- void Inno3Pro_Write_CV_Load (uint16_t u16Load)

Constant Voltage Load setting.

- void Inno3Pro_Write_Loop_Speed1 (uint16_t u16LoopSpeed)

Loop Speed 1 Setting.

- void Inno3Pro_Write_Loop_Speed2 (uint16_t u16LoopSpeed)

Loop Speed 2 Setting.

- bool Inno3Pro_Write_VI (float fSetPtCV, float fSetPtCC)

Output Voltage Control with Bleeder Control and Constant Current (CC) Control.

- bool Inno3Pro_Process_Voltage (bool bVoltIncrease)

Handles Command Sequences for Voltage Increment/Decrement.

Common API Telemetry Functions

These functions are used as base for the main API Read functions

- uint16_t Inno3Pro_Telemetry (uint8_t ReadBack_Address)

Handles InnoSwitch3-Pro Common I2C Read Back Telemetry.

- bool Inno3Pro_Read_Bit (uint8_t ReadBack_Address, uint8_t Bit)

Handles InnoSwitch3-Pro I2C Read Bit.

- uint8_t Inno3Pro_Read_Byte (uint8_t ReadBack_Address, bool bHighByte)

Handles InnoSwitch3-Pro I2C Read Byte.

- uint8_t Inno3Pro_Read_2Bits (uint8_t ReadBack_Address, uint8_t u8ShiftCnt)

Handles InnoSwitch3-Pro I2C Read 2 Bitss.

- float Inno3Pro_Read_SetPoint (uint16_t ReadBack_Address, float fMultiplier)

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Handles InnoSwitch3-Pro I2C Set Point and Threshold.

Read1 - Main API Telemetry Functions

Telemetry API for Read1

- float Inno3Pro_Read_CV_SetPoint (void)

Reads the Telemetry register Read1 - Output Voltage Set-Point.

Read2 - Main API Telemetry Functions

Telemetry API for Read2

- float Inno3Pro_Read_UV_Threshold (void)

Reads the Telemetry register Read2 - Under Voltage Threshold.

Read3 - Main API Telemetry Functions

Telemetry API for Read3

- float Inno3Pro_Read_OV_Threshold (void)

Reads the Telemetry register Read3 - Over Voltage Threshold.

Read4 - Main API Telemetry Functions

Telemetry API for Read4

- bool Inno3Pro_Read_VbusSwitch (void)

Reads bit 14 on Telemetry register Read4 - VBUS Switch Enable.

- bool Inno3Pro_Read_Bleeder (void)

Reads bit 13 on Telemetry register Read4 - Minimum Load (Bleeder)

- bool Inno3Pro_Read_PsuOff (void)

Reads bit 12 on Telemetry register Read4 - Turn PSU Off (Latch Off Device)

- bool Inno3Pro_Read_FastVI (void)

Reads bit 11 on Telemetry register Read4 - Fast VI Commands.

- bool Inno3Pro_Read_CvoMode (void)

Reads bit 10 on Telemetry register Read4 - Constant-Voltage Mode Only.

- bool Inno3Pro_Read_OtpFaultHyst (void)

Reads bit 9 on Telemetry register Read4 - Over-Temperature Protection.

- float Inno3Pro_Read_Cable_Drop_Comp (void)

Reads the Telemetry register Read4 - Cable Drop Compensation.

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Read5 - Main API Telemetry Functions

Telemetry API for Read5

- float Inno3Pro_Read_CC_SetPoint (void)

Reads the Telemetry register READ5 - Constant Current Set-Point.

- float Inno3Pro_Read_CP_Threshold (void)

Reads the Telemetry register READ5 - Constant Power Threshold.

Read6 - Main API Telemetry Functions

Telemetry API for Read6

- uint8_t Inno3Pro_Read_OV_Fault_Response (void)

Reads the Telemetry register READ6 - Overvoltage Fault Response.

- uint8_t Inno3Pro_Read_UV_Fault_Response (void)

Reads the Telemetry register READ6 - Under voltage Fault Response.

- uint8_t Inno3Pro_Read_OutputSckt_Fault_Response (void)

Reads the Telemetry register READ6 – Output Short-Circuit Fault Response

- uint8_t Inno3Pro_Read_IsPinShort_Fault_Response (void)

Reads the Telemetry register READ6 - IS-pin Short Fault Response.

- uint8_t Inno3Pro_Read_UV_Fault_Timer (void)

Reads the Telemetry register READ6 – Under voltage Timer.

- uint8_t Inno3Pro_Read_Watchdog_Timer (void)

Reads the Telemetry register READ6 - Watchdog Timer.

- uint8_t Inno3Pro_Read_CvMode_Fault_Response (void)

Reads the Telemetry register READ6 - Constant Voltage Mode Fault Response.

- uint8_t Inno3Pro_Read_CvMode_Timer (void)

Reads the Telemetry register READ6 - Constant Voltage Mode Timer.

Read7 - Main API Telemetry Functions

Telemetry API for Read7

- float Inno3Pro_Read_Amps (void)

Reads the Telemetry register Read7 - Measured Output Current.

Read9 - Main API Telemetry Functions

Telemetry API for Read9

- float Inno3Pro_Read_Volts (void)

Reads the Telemetry register Read9 - Measured Output Voltage.

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Read10 - Main API Telemetry Functions

Telemetry API for Read10

- bool Inno3Pro_Read_Status_InterruptEnable (void)

Reads bit 15 on Telemetry register Read10 - Interrupt Enable.

- bool Inno3Pro_Read_Status_SystemReady (void)

Reads bit 14 on Telemetry register Read10 - System Ready Signal.

- bool Inno3Pro_Read_Status_OutputDischarge (void)

Reads bit 13 on Telemetry register Read10 - Output Discharge.

- bool Inno3Pro_Read_Status_HighSwitchFreq (void)

Reads bit 12 on Telemetry register Read10 - Switching Frequency High.

- bool Inno3Pro_Read_Status_OtpFault (void)

Reads bit 9 on Telemetry register Read10 - Over-Temperature Protection.

- bool Inno3Pro_Read_Status_Vout2pct (void)

Reads bit 5 on Telemetry register Read10 - 2% Bleeder Enabled.

- bool Inno3Pro_Read_Status_Vout10pct (void)

*Reads bit 4 on Telemetry register Read10 - VOUTADC > 1.1*Vout.*

- bool Inno3Pro_Read_Status_IsPinShort (void)

Reads bit 3 on Telemetry register Read10 - IS-pin Short Circuit Detected.

- bool Inno3Pro_Read_Status_OutputShorCkt (void)

Reads bit 3 on Telemetry register Read10 – Output Short Circuit Detected.

- bool Inno3Pro_Read_Status_UV_Fault (void)

Reads bit 1 on Telemetry register Read10 - Output Voltage UV Fault Comparator.

- bool Inno3Pro_Read_Status_OV_Fault (void)

Reads bit 0 on Telemetry register Read10 - Output Voltage OV Fault Comparator.

Read11 - Main API Telemetry Functions

Telemetry API for Read11

- bool Inno3Pro_Read_Status_CvoMode_AR (void)

Reads bit 15 on Telemetry register Read11 - CVO Mode Auto Restart(AR)

- bool Inno3Pro_Read_Status_IsPinShort_AR (void)

Reads bit 12 on Telemetry register Read11 - IS-pin Short Circuit Auto Restart(AR)

- bool Inno3Pro_Read_Status_OutputShortCkt_AR (void)

Reads bit 12 on Telemetry register Read11 - Output Short Circuit Auto Restart(AR)

- bool Inno3Pro_Read_Status_OV_AR (void)

Reads bit 10 on Telemetry register Read11 - Output Voltage OV Auto Restart(AR)

- bool Inno3Pro_Read_Status_UV_AR (void)

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Reads bit 9 on Telemetry register Read11 - Output Voltage UV Auto Restart(AR)

- bool Inno3Pro_Read_Status_LatchOff (void)

Reads bit 7 on Telemetry register Read11 - Latch-Off (LO) Occurred.

- bool Inno3Pro_Read_Status_CvoMode_LO (void)

Reads bit 6 on Telemetry register Read11 - CVO Mode Latch Off (LO)

- bool Inno3Pro_Read_Status_PsuOffCmd (void)

Reads bit 5 on Telemetry register Read11 - PSU Turn-Off Command Received.

- bool Inno3Pro_Read_Status_IsPinShort_LO (void)

Reads bit 4 on Telemetry register Read11 - IS-pin Short Circuit Latch Off (LO)

- bool Inno3Pro_Read_Status_OV_LO (void)

Reads bit 2 on Telemetry register Read11 - Output Voltage OV Latch Off (LO)

- bool Inno3Pro_Read_Status_UV_LO (void)

Reads bit 1 on Telemetry register Read11 - Output Voltage UV Latch Off (LO)

- bool Inno3Pro_Read_Status_BPS_LO (void)

Reads bit 0 on Telemetry register Read11 - BPS-pin Latch Off (LO)

Read12 - Main API Telemetry Functions

Telemetry API for Read12

- bool Inno3Pro_Read_Interrupt_Mask_CntrlSecondary (void)

Reads bit 14 on Telemetry register Read12 - Interrupt Mask Control Secondary.

- bool Inno3Pro_Read_Interrupt_Mask_BpsCurrentLo (void)

Reads bit 13 on Telemetry register Read12 - Interrupt Mask BPS Current Latch-off.

- bool Inno3Pro_Read_Interrupt_Mask_CvoPkLoadTimer (void)

Reads bit 12 on Telemetry register Read12 - Interrupt Mask BPS Current Latch-off.

- bool Inno3Pro_Read_Interrupt_Mask_IsPinShort (void)

Reads bit 11 on Telemetry register Read12 - Interrupt Mask IS-pin Short.

- bool Inno3Pro_Read_Interrupt_Mask_OutputShortCkt (void)

Reads bit 10 on Telemetry register Read12 - Interrupt Mask Output Short Circuit.

- bool Inno3Pro_Read_Interrupt_Mask_UV (void)

Reads bit 9 on Telemetry register Read12 - Interrupt Mask Vout Undervoltage(UV)

- bool Inno3Pro_Read_Interrupt_Mask_OV (void)

Reads bit 8 on Telemetry register Read12 - Interrupt Mask Vout Overvoltage(OV)

- bool Inno3Pro_Read_Interrupt_Stat_CntrlSecondary (void)

Reads bit 6 on Telemetry register Read12 - Interrupt Status Control Secondary.

- bool Inno3Pro_Read_Interrupt_Stat_BpsCurrentLo (void)

Reads bit 6 on Telemetry register Read12 - Interrupt Status for Control Secondary.

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- bool Inno3Pro_Read_Interrupt_Stat_CvoPkLoadTimer (void)

Reads bit 5 on Telemetry register Read12 - Interrupt Status for CVO Mode Peak load timer.

- bool Inno3Pro_Read_Interrupt_Stat_IsPinShort (void)

Reads bit 3 on Telemetry register Read12 - Interrupt Status for Status IS-pin Short.

- bool Inno3Pro_Read_Interrupt_Stat_UV (void)

Reads bit 1 on Telemetry register Read12 - Interrupt Status for Status Vout(UV)

- bool Inno3Pro_Read_Interrupt_Stat_OV (void)

Reads bit 0 on Telemetry register Read12 - Interrupt Status for Status Vout(OV)

Read13 - Main API Telemetry Functions

Telemetry API for Read13

- float Inno3Pro_Read_AmpsAverage (void)

Reads the Telemetry register Read13 - Average Output Current.

Read14 - Main API Telemetry Functions

Read14 - Main API Telemetry Functions

- float Inno3Pro_Read_VoltsAverage (void)

Reads the Telemetry register Read14 - Average Output Voltage.

Read15 - Main API Telemetry Functions

Telemetry API for Read15

- float Inno3Pro_Read_Voltage_DAC (void)

Reads the Telemetry register Read15 - Voltage DAC.

12.4.2 Variables

Local Variables.

- static volatile float fInno3Pro_CV = (float)(5)
- static volatile float fInno3Pro_OVA = (float)(6.2)
- static volatile float fInno3Pro_UVA = (float)(3)
- static volatile float fInno3Pro_CDC = (float)(300)
- static volatile float fInno3Pro_CC = (float)(5.1)
- static volatile float fInno3Pro_VKP = (float)(7)
- static volatile float fInno3Pro_VBEN = (float)(0)
- static volatile float fInno3Pro_UVL = (float)(0)

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InnoSwitch3-Pro Flags

Example Flags Used for Application specific routines

Used for Specific InnoSwitch3-Pro Routines

- bool b_Lock_Timer_Is_Running = false
- bool b_Lock_Enable = false
- bool b_Setting_Update = false
- bool b_Request_Enable = false
- volatile bool b_Volt_Setting = false

InnoSwitch3-Pro Calibration Variables

Sets the variables needed for computations

- float fInno3Pro_Rsense = (float)(5.25)

InnoSwitch3-Pro I2C Register Buffers

Individual Array Buffers Used for I2C Communication Each Corresponds to an InnoSwitch3-Pro I2C register

These Array Buffers needs to be filled with LSB and MSB values. These are used directly for Writing values to InnoSwitch3-Pro via I2C. These values are Initialize with InnoSwitch3-Pro Default Values.

```
Buffer[0]  - LSB
Buffer[1]  - MSB
```

- volatile uint8_t u8_Buffer_VBEN [2] ={0}
- volatile uint8_t u8_Buffer_BLEEDER [2] ={0}
- volatile uint8_t u8_Buffer_VDIS [2] ={0}
- volatile uint8_t u8_Buffer_TURN_OFF_PSU [2] ={0}
- volatile uint8_t u8_Buffer_FAST_VI_CMD [2] ={0}
- volatile uint8_t u8_Buffer_CVO [2] ={0}
- volatile uint8_t u8_Buffer_CV [2] ={0}
- volatile uint8_t u8_Buffer_OVA [2] ={0}
- volatile uint8_t u8_Buffer_UVA [2] ={0}
- volatile uint8_t u8_Buffer_CDC [2] ={0}
- volatile uint8_t u8_Buffer_CCSC [2] ={0}
- volatile uint8_t u8_Buffer_CC [2] ={0}
- volatile uint8_t u8_Buffer_VKP [2] ={0}
- volatile uint8_t u8_Buffer_OVL [2] ={0}
- volatile uint8_t u8_Buffer_UVL [2] ={0}
- volatile uint8_t u8_Buffer_CCSC[2] ={0}
- volatile uint8_t u8_Buffer_ISSC [2] ={0}

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- volatile uint8_t u8_Buffer_UVL_TIMER [2] ={0}
- volatile uint8_t u8_Buffer_WATCHDOG_TIMER [2] ={0}
- volatile uint8_t u8_Buffer_CVOL [2] ={0}
- volatile uint8_t u8_Buffer_CVOL_TIMER [2] ={0}
- volatile uint8_t u8_Buffer_INTERRUPT [2] ={0}
- volatile uint8_t u8_Buffer_OTP [2] ={0}
- volatile uint8_t u8_Buffer_CVLOAD [2] ={0}
- volatile uint8_t u8_Buffer_LoopSpeed1 [2] ={0}
- volatile uint8_t u8_Buffer_LoopSpeed2 [2] ={0}

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12.4.3 Function Documentation

12.4.3.1 void Inno3Pro_Bleeder_Enable (bool bEnable)

Handles Bleeder Setting.

This function Writes to bleeder register. The BLEEDER register must not be enabled for extended period of time to prevent excessive power dissipation in the controller

12.4.3.2 Parameters:

bEnable	- Value to Enable Bleeder

Input Values:

False: Disable Bleeder
True : Enable Bleeder

12.4.3.3 Returns:

None

12.4.3.4 float Inno3Pro_Compute_CC (float fSetPt)

InnoSwitch3-Pro Computation for Constant Current Regulation (CC)
Calculates the value based on 0.25mV/Step/Rsense Resolution.

Note:

This Function Applies Range Limits to the Set Point Value

Precondition:

None

Postcondition:

Returned Value Range: 25 to 128 (20% to 100% of CC)

Parameters:

fSetPt	- Set Point Value

Returns:

Computed CC Value

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12.4.3.5 float Inno3Pro_Compute_CDC (float fSetPt)

InnoSwitch3-Pro Computation for Cable Drop Compensation (CDC)
Calculates the value based on 50mV/LSB Resolution.

Note:
This Function Applies Range Limits to the Set Point Value

Precondition:
None

Postcondition:
Returned Value Range: 0 to 12 (0V to 600mV)

Parameters:

fSetPt	- Set Point Value

Returns:
Computed CDC Value

Definition at line 186 of file Inno3Pro.c.

12.4.3.6 float Inno3Pro_Compute_CV (float fSetPt)

InnoSwitch3-Pro Computation for Output Voltage (CV)
Calculates the value based on 10mV/LSB Resolution.

Note:
This Function Applies Range Limits to the Set Point Value

Precondition:
None

Postcondition:
Returned Value Range: 300 to 2400 (3V to 24V)

Parameters:

fSetPt	- Set Point Value

Returns:
Computed CV Value

12.4.3.7 float Inno3Pro_Compute_OV (float fSetPt)

InnoSwitch3-Pro Computation for Over-Voltage Threshold (OVA)
Calculates the value based on 100mV/LSB Resolution.

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Note:
This Function Applies Range Limits to the Set Point Value
Precondition:
None
Postcondition:
Returned Value Range: 62 to 250 (6.2V to 25V)
Parameters:

fSetPt	- Set Point Value

Returns:
Computed OVA Value

12.4.3.8 float Inno3Pro_Compute_UV (float fSetPt)

InnoSwitch3-Pro Computation for Under-Voltage Threshold (UVA)
Calculates the value based on 100mV/LSB Resolution.

Note:
This Function Applies Range Limits to the Set Point Value
Precondition:
None
Postcondition:
Returned Value Range: 30 to 240 (3V to 24V)
Parameters:

fSetPt	- Set Point Value

Returns:
Computed UVA Value

12.4.3.9 float Inno3Pro_Compute_VBEN (float fSetPt)

InnoSwitch3-Pro Computation for Series Bus Switch Control (VBEN)

Note:
This function Doesn't have any computation, Only Applies Range limits
Precondition:
None
Postcondition:
Returned Value Range: 0 or 3 (0: Disabled or Bus SW Open , 3: Enabled or Bus SW Closed)
Parameters:

fSetPt	- Set Point Value

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Returns:

VBEN Value

12.4.3.10 float Inno3Pro_Compute_VKP (float fSetPt)

InnoSwitch3-Pro Computation for Output Power Knee Voltage (VKP)

Calculates the value based on 100mV/LSB Resolution.

Note:

This Function Applies Range Limits to the Set Point Value

Precondition:

None

Postcondition:

Returned Value Range: 53 to 240 (5.3V to 24V)

Parameters:

fSetPt	- Set Point Value

Returns:

Computed VKP Value

12.4.3.11 void Inno3Pro_CVOnlyMode_Enable (bool bEnable)

Constant voltage only mode.

This function sets the device to constant voltage only and have no constant current regulation mode.

Once the load current exceeds the programmed current, fault setting is activated after CVOL timer expires

Parameters:

bEnable	- Value to enable CVO mode

Input Values:

False: CV and CC Enabled

True : CV Only Mode/No CC

Returns:

None

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12.4.3.12 bool Inno3Pro_Detect_Current_Request (void)

Checks if there's a new Current Request.

Checks if there's a new Current Request then returns true

Precondition:

None

Parameters:

None	

Returns:

True - if CC has changed

12.4.3.13 bool Inno3Pro_Detect_Voltage_Request (void)

Checks if there's a new Voltage Request.

This checks whether the New Voltage(CV) Value to Be written is Higher or lower than the previous Voltage(CV) and decides either to increment or decrement the voltage setting of the InnoSwitch3-Pro

Precondition:

None

Parameters:

None	

Returns:

True - if CV has changed

12.4.3.14 void Inno3Pro_Encode_Buffer (uint16_t u16Temp, uint8_t * u8WriteBuffer)

InnoSwitch3-Pro Conversion for I2C buffers.

Note:

This function Converts the Data Input to Hexadecimal LSB and MSB that will be stored on the I2C write buffers.

Precondition:

None

Parameters:

u16Temp	- Value to be converted
u8WriteBuffer	- A pointer to the memory location where the converted data will be stored

Returns:

None

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12.4.3.15 void Inno3Pro_Encode_Buffer_Parity (uint16_t u16Temp, uint8_t * u8WriteBuffer)

InnoSwitch3-Pro Conversion for I2C buffers.

Note:

This function Converts the Data Input to Hexadecimal LSB and MSB. After parity is added the hex equivalent will be stored on the I2C write buffers.

Precondition:

None

Parameters:

u16Temp	- Value to be converted
u8WriteBuffer	- A pointer to the memory location where the converted data will be stored

Returns:

None

12.4.3.16 void Inno3Pro_FastVI_Disable (bool bDisable)

CV and CC Commands speed limit.

This function limits the maximum speed (10ms) in which CV and CC commands can be sent to the device.

Note:

Speed limit can be removed as needed

Parameters:

bEnable	- Value to Set the Speed Limit

Input Values:

False: 10ms Update Limit Enabled

True : No Speed Limit

Returns:

None

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12.4.3.17 float Inno3Pro_Get_Register_CC (void) [inline]

12.4.3.18 float Inno3Pro_Get_Register_CDC (void) [inline]

12.4.3.19 float Inno3Pro_Get_Register_CV (void) [inline]

12.4.3.20 float Inno3Pro_Get_Register_OVA (void) [inline]

12.4.3.21 float Inno3Pro_Get_Register_UVA (void) [inline]

12.4.3.22 float Inno3Pro_Get_Register_UVL (void) [inline]

12.4.3.23 float Inno3Pro_Get_Register_VBEN (void) [inline]

12.4.3.24 float Inno3Pro_Get_Register_VKP (void) [inline]

12.4.3.25 float Inno3Pro_Get_Rsense_Value (void)

12.4.3.26 void Inno3Pro_Initialization (void)

Handles all Common I2C Configurations to be written to InnoSwitch3-Pro as initialization.

This Reads the InnoSwitch3-Pro System Ready Signal to check if InnoSwitch3-Pro is ready to communicate. Once InnoSwitch3-Pro is ready ,This function configures the Initial registers needed for operation.

Needs to be called on the beginning to Initialize InnoSwitch3-Pro Settings

Parameters:

None	

Returns:

None

12.4.3.27 void Inno3Pro_Load_Discharge (bool bEnable)

Activates Vbus Load Discharge.

This function Writes to Load Discharge register.

Note:

Enabling the VDIS register will automatically disable the VBEN register

Parameters:

bEnable	- Value to Enable Load Discharge

Input Values:

False: Disable Load Discharge

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True : Enable Load Discharge

Returns:

None

12.4.3.28 bool Inno3Pro_OddParity (uint8_t u8OddParity)

InnoSwitch3-Pro Odd Parity Bit Detection.

Note:

This function Detects the No of 1s in a Byte

Precondition:

None

Parameters:

u8OddParity	- Byte to be Evaluated with Parity

Returns:

True - If the no 1s is Odd number

12.4.3.29 void Inno3Pro_Process_Volt_Buffers (void)

Handles Preparation for values to be written on InnoSwitch3-Pro Voltage Related Registers.

Uses a conversion method to Split the Decimal Value into LSB and MSB values and Fill the Specific I2C Buffers with these values.

Precondition:

None

Parameters:

None	

Returns:

None

12.4.3.30 bool Inno3Pro_Process_Voltage (bool bVoltIncrease)

Handles Command Sequences for Voltage Increment/Decrement.

This function follows a certain sequence of commands in order to avoid inadvertent triggering of UV or OV faults

Parameters:

bVoltIncrease	- True or False Value to Increase or Decrease Voltage

Returns:

True - I2C commands are successfully written

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12.4.3.31 uint8_t Inno3Pro_Read_2Bits (uint8_t ReadBack_Address, uint8_t u8ShiftCnt)

Handles InnoSwitch3-Pro I2C Read 2 Bitss.

This function Reads to 2 Bits of each Telemetry register

Precondition:

I2C_Read16() Driver should be already Configured and is able to Read I2C commands

Parameters:

ReadBack_Address	- Read Back Register Address u8ShiftCnt -Number of Right Shift applied to the reading

Returns:

Byte Reading

12.4.3.32 float Inno3Pro_Read_Amps (void)

Reads the Telemetry register Read7 - Measured Output Current.

This function provides the measured output current.

The output current measurement ADC full range is 128.

This function removes the Odd parity on bit 15 and bit 7 and process it to actual measurements.

Parameters:

None	

Returns:

Current Reading in Amps

12.4.3.33 float Inno3Pro_Read_AmpsAverage (void)

Reads the Telemetry register Read13 - Average Output Current.

This function provides the average measured output current.

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The average output current measurement is simply 16-samples rolling average of the READ7 (measured output current) and the ADC full range is 128 and with No Odd-Parity.

Parameters:

None	

Returns:

Current Reading in Amps

12.4.3.34 bool Inno3Pro_Read_Bit (uint8_t ReadBack_Address, uint8_t Bit)

Handles InnoSwitch3-Pro I2C Read Bit.

This function Reads the Specific Bit of each Telemetry register

Precondition:

I2C_Read16() Driver should be already Configured and is able to Read I2C commands

Parameters:

ReadBack_Address	- Read Back Register Address Bit - Bit Count of the Register to Read

Returns:

Bit Reading

12.4.3.35 bool Inno3Pro_Read_Bleeder (void)

Reads bit 13 on Telemetry register Read4 - Minimum Load (Bleeder)

This function provides the current status of the Bleeder

Parameters:

None	

Returns:

True - Bleeder is ON
False - Bleeder is OFF

12.4.3.36 uint8_t Inno3Pro_Read_Byte (uint8_t ReadBack_Address, bool bHighByte)

Handles InnoSwitch3-Pro I2C Read Byte.

This function Reads the LSB or MSB of each Telemetry register

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Precondition:

I2C_Read16() Driver should be already Configured and is able to Read I2C commands

Parameters:

ReadBack_Address	- Read Back Register Address bHighByte - Selects the LSB or MSB of the Register to Read

Returns:

Byte Reading

12.4.3.37 float Inno3Pro_Read_Cable_Drop_Comp (void)

Reads the Telemetry register Read4 - Cable Drop Compensation.

This function provides the current Cable Drop Compensation that was programmed on the CDC Register

Parameters:

None	

Returns:

Cable Drop Compensation in millivolts (mV)

12.4.3.38 float Inno3Pro_Read_CC_SetPoint (void)

Reads the Telemetry register READ5 - Constant Current Set-Point.

This function provides the Constant Current setting that was programmed on the CC Register

Parameters:

None	

Returns:

Constant Current Set-Point in Amperes

12.4.3.39 float Inno3Pro_Read_CP_Threshold (void)

Reads the Telemetry register READ5 - Constant Power Threshold.

This function provides the Constant Power setting that was programmed on the VKP Register

Parameters:

None	

Returns:

Constant Power Threshold in Volts

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12.4.3.40 float Inno3Pro_Read_CV_SetPoint (void)

Reads the Telemetry register Read1 - Output Voltage Set-Point.

This function provides the output voltage setting that was programmed on the CV Register

Parameters:

None	

Returns:

The Output Voltage Set Point in Volts

12.4.3.41 uint8_t Inno3Pro_Read_CvMode_Fault_Response (void)

Reads the Telemetry register READ6 - Constant Voltage Mode Fault Response.

This function provides the Constant Voltage Mode Response setting that was programmed on the CVOL Register

This determines the action that InnoSwitch3-Pro will take in response to a Constant Voltage Mode Fault

Parameters:

None	

Returns:

Constant Voltage Mode Fault Response in Byte

12.4.3.42 uint8_t Inno3Pro_Read_CvMode_Timer (void)

Reads the Telemetry register READ6 - Constant Voltage Mode Timer.

This function provides the Constant Voltage Mode Timeout setting that was programmed on the CVOL Timer Register

Parameters:

None	

Returns:

Watchdog Timer Timeout in Byte

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12.4.3.43 bool Inno3Pro_Read_CvoMode (void)

Reads bit 10 on Telemetry register Read4 - Constant-Voltage Mode Only.

This function tells if InnoSwitch3-Pro is operating on Constant Voltage Only Mode or both constant voltage and constant current regulation mode is running

Parameters:

None	

Returns:

True - CV Only Mode/No CC Regulation
False - CV and CC Mode Enabled

12.4.3.44 bool Inno3Pro_Read_FastVI (void)

Reads bit 11 on Telemetry register Read4 - Fast VI Commands.

This function provides the current setting of the Fast VI Command Register

Parameters:

None	

Returns:

True - No Speed Limit (10ms update limit is disabled)
False - 10ms Update Limit must be observed

12.4.3.45 bool Inno3Pro_Read_Interrupt_Mask_BpsCurrentLo (void)

Reads bit 13 on Telemetry register Read12 - Interrupt Mask BPS Current Latch-off.

This function provides the bit setting of the BPS Current Latch-off that was programmed on the Interrupt Register

Note:

Once a fault occurs, the Interrupt Mask is reset and must be re-enabled to activate the SCL reporting scheme.

Parameters:

None	

Returns:

True - Interrupt for BPS Current Latch-off is Enabled
False - Interrupt for BPS Current Latch-off Disabled

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12.4.3.46 bool Inno3Pro_Read_Interrupt_Mask_CntrlSecondary (void)

Reads bit 14 on Telemetry register Read12 - Interrupt Mask Control Secondary.

This function provides the bit setting of the Control Secondary that was programmed on the Interrupt Register

Note:

Once a fault occurs, the Interrupt Mask is reset and must be re-enabled to activate the SCL reporting scheme.

Parameters:

None	

Returns:

True - Interrupt for Control Secondary is Enabled
False - Interrupt for Control Secondary is Disabled

12.4.3.47 bool Inno3Pro_Read_Interrupt_Mask_CvoPkLoadTimer (void)

Reads bit 12 on Telemetry register Read12 - Interrupt Mask BPS Current Latch-off.

This function provides the bit setting of the CVO Mode Peak load timer that was programmed on the Interrupt Register

Note:

Once a fault occurs, the Interrupt Mask is reset and must be re-enabled to activate the SCL reporting scheme.

Parameters:

None	

Returns:

True - Interrupt for CVO Mode Peak load Timer is Enabled
False - Interrupt for CVO Mode Peak load Timer is Disabled

12.4.3.48 bool Inno3Pro_Read_Interrupt_Mask_IsPinShort (void)

Reads bit 11 on Telemetry register Read12 - Interrupt Mask IS-pin Short.

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This function provides the bit setting of the Interrupt Mask IS-pin Short that was programmed on the Interrupt Register

Note:

Once a fault occurs, the Interrupt Mask is reset and must be re-enabled to activate the SCL reporting scheme.

Parameters:

None	

Returns:

True - Interrupt for IS-pin Short is Enabled
False - Interrupt for IS-pin Short is Disabled

12.4.3.49 bool Inno3Pro_Read_Interrupt_Mask_OutputShortCkt(void)

Reads bit 10 on Telemetry register READ12 – Interrupt Mask Output Short Circuit

This function provides the bit setting of the Interrupt Mask Output Short Circuit that was programmed on the Interrupt Register

Note:

Once a fault occurs, the Interrupt Mask is reset and must be re-enabled to activate the SCL reporting scheme.

Parameters:

None	

Returns:

True - Interrupt for Output Short Circuit is Enabled
False - Interrupt for Output Short Circuit is Disabled

12.4.3.50 bool Inno3Pro_Read_Interrupt_Mask_OV (void)

Reads bit 8 on Telemetry register Read12 - Interrupt Mask Vout Overvoltage(OV)

This function provides the bit setting of the Interrupt Mask Vout(OV) that was programmed on the Interrupt Register

Note:

Once a fault occurs, the Interrupt Mask is reset and must be re-enabled to activate the SCL reporting scheme.

Parameters:

None	

Returns:

True - Interrupt for Vout (OV) is Enabled
False - Interrupt for Vout (OV) is Disabled

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12.4.3.51 bool Inno3Pro_Read_Interrupt_Mask_UV (void)

Reads bit 9 on Telemetry register Read12 - Interrupt Mask Vout Undervoltage(UV)

This function provides the bit setting of the Interrupt Mask Vout(UV) that was programmed on the Interrupt Register

Note:

Once a fault occurs, the Interrupt Mask is reset and must be re-enabled to activate the SCL reporting scheme.

Parameters:

None	

Returns:

True - Interrupt for Vout (UV) is Enabled
False - Interrupt for Vout (UV) is Disabled

12.4.3.52 bool Inno3Pro_Read_Interrupt_Stat_BpsCurrentLo (void)

Reads bit 6 on Telemetry register Read12 - Interrupt Status for Control Secondary.

This function tells that Control Secondary fault has occurred and an Interrupt on the SCL was generated

Note:

Once a fault occurs, the Interrupt Mask is reset and must be re-enabled to activate the SCL reporting scheme.

Parameters:

None	

Returns:

True - Control Secondary fault has occurred
False - No Fault

12.4.3.53 bool Inno3Pro_Read_Interrupt_Stat_CntrlSecondary (void)

Reads bit 6 on Telemetry register Read12 - Interrupt Status Control Secondary.

This function tells that Control Secondary fault has occurred and an Interrupt on the SCL was generated

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Note:

Once a fault occurs, the Interrupt Mask is reset and must be re-enabled to activate the SCL reporting scheme.

Parameters:

None	

Returns:

True - Control Secondary fault has occurred
False - No Fault

12.4.3.54 bool Inno3Pro_Read_Interrupt_Stat_CvoPkLoadTimer (void)

Reads bit 5 on Telemetry register Read12 - Interrupt Status for CVO Mode Peak load timer.

This function tells that CVO fault has occurred and an Interrupt on the SCL was generated

Note:

Once a fault occurs, the Interrupt Mask is reset and must be re-enabled to activate the SCL reporting scheme.

Parameters:

None	

Returns:

True - Constant Voltage Mode Fault has occurred
False - No Fault

12.4.3.55 bool Inno3Pro_Read_Interrupt_Stat_IsPinShort (void)

Reads bit 3 on Telemetry register Read12 - Interrupt Status for Status IS-pin Short.

This function tells that IS-pin Short has occurred and an Interrupt on the SCL was generated

Note:

Once a fault occurs, the Interrupt Mask is reset and must be re-enabled to activate the SCL reporting scheme.

Parameters:

None	

Returns:

True - IS-pin Short has occurred
False - No Fault

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12.4.3.56 bool Inno3Pro_Read_Interrupt_Stat_OV (void)

Reads bit 0 on Telemetry register Read12 - Interrupt Status for Status Vout(OV)

This function tells that Vout Overvoltage Fault has occurred and an Interrupt on the SCL was generated

Note:

Once a fault occurs, the Interrupt Mask is reset and the particular faults of interest must be re-enabled to activate the SCL reporting scheme.

Parameters:

None	

Returns:

True - Vout Overvoltage(OV) Fault has occurred
False - No Fault

12.4.3.57 bool Inno3Pro_Read_Interrupt_Stat_UV (void)

Reads bit 1 on Telemetry register Read12 - Interrupt Status for Status Vout(UV)

This function tells that Vout Undervoltage Fault has occurred and an Interrupt on the SCL was generated

Note:

Once a fault occurs, the Interrupt Mask is reset and must be re-enabled to activate the SCL reporting scheme.

Parameters:

None	

Returns:

True - Vout Undervoltage(UV) Fault has occurred
False - No Fault

12.4.3.58 uint8_t Inno3Pro_Read_IsPinShort_Fault_Response (void)

Reads the Telemetry register READ6 - IS-pin Short Fault Response.

This function provides the IS-pin Short Fault Response setting that was programmed on the 1st 2 bits of the ISSC Register

This determines the action that InnoSwitch3-Pro will take in response to the IS-pin Short Fault

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Parameters:

None	

Returns:

IS-pin Short Fault Response in Byte

12.4.3.59 bool Inno3Pro_Read_OtpFaultHyst (void)

Reads bit 9 on Telemetry register Read4 - Over-Temperature Protection.

This function provides the current setting of the Secondary Over Temperature Fault Hysteresis or OTP Register

Parameters:

None	

Returns:

True - 60 Degrees
False - 40 Degrees

12.4.3.60 uint8_t Inno3Pro_Read_OutputSckt_Fault_Response(void)

Reads the Telemetry register READ6 – Output Short-Circuit.

This function provides the Output Short-Circuit Setting that was programmed on the CCSC Register.

Parameters:

None	

Returns:

Output Short-Circuit Fault Response in Byte

12.4.3.61 uint8_t Inno3Pro_Read_OV_Fault_Response (void)

Reads the Telemetry register READ6 - Overvoltage Fault Response.

This function provides the Overvoltage Fault Response setting that was programmed on the OVL Register

This determines the action that InnoSwitch3-Pro will take in response to an output Overvoltage fault

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Parameters:

None	

Returns:

Overvoltage Fault Response in Byte

12.4.3.62 float Inno3Pro_Read_OV_Threshold (void)

Reads the Telemetry register Read3 - Over Voltage Threshold.

This function provides the Over Voltage setting that was programmed on the OVA Register

Parameters:

None	

Returns:

Over Voltage Threshold in Volts

12.4.3.63 bool Inno3Pro_Read_PsuOff (void)

Reads bit 12 on Telemetry register Read4 - Turn PSU Off (Latch Off Device)

This function provides the current setting of the PSU

Parameters:

None	

Returns:

True - Latch Off Device is Enabled

False - Latch Off Device is Disabled

12.4.3.64 float Inno3Pro_Read_SetPoint (uint16_t ReadBack_Address, float fMultiplier)

Handles InnoSwitch3-Pro I2C Set Point and Threshold.

This function is used for CV,OV,UV Thresholds and Set-Point

Precondition:

I2C_Read16() Driver should be already Configured and is able to Read I2C commands

Parameters:

ReadBack_Address	- Read Back Register Address fMultiplier - Factor to be used for the Set Point computation

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Returns:
Byte Reading

12.4.3.65 bool Inno3Pro_Read_Status_BPS_LO (void)

Reads bit 0 on Telemetry register Read11 - BPS-pin Latch Off (LO)

This function tells that Latch-Off mode happened because of Overvoltage was detected on the BPS Pin

Parameters:

None	

Returns:
True - Output Voltage Overvoltage LO Occurred
False - No Fault

12.4.3.66 bool Inno3Pro_Read_Status_CvoMode_AR (void)

Reads bit 15 on Telemetry register Read11 - CVO Mode Auto Restart(AR)

This function tells that an Auto Restart happened while InnoSwitch3-Pro is operating in Constant Voltage Mode Only

Parameters:

None	

Returns:
True - CVO Mode Auto Restart Occurred
False - No Fault

12.4.3.67 bool Inno3Pro_Read_Status_CvoMode_LO (void)

Reads bit 6 on Telemetry register Read11 - CVO Mode Latch Off (LO)

This function tells that Latch-Off mode happened while InnoSwitch3-Pro is operating in Constant Voltage Mode Only

Parameters:

None	

Returns:
True - CVO Mode Latch Off Occurred
False - No Fault

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12.4.3.68 bool Inno3Pro_Read_Status_HighSwitchFreq (void)

Reads bit 12 on Telemetry register Read10 - Switching Frequency High.

This function tells if InnoSwitch3-Pro is operating at High Switching Frequency.

The READ10 telemetry registers are instantaneous and are cleared whenever the condition is no longer valid.

Parameters:

None	

Returns:

True - High Switching Frequency
False - Low Switching Frequency

12.4.3.69 bool Inno3Pro_Read_Status_InterruptEnable (void)

Reads bit 15 on Telemetry register Read10 - Interrupt Enable.

This function provides the current status of the Active interrupt reporting scheme on the SCL Pin

The READ10 telemetry registers are instantaneous and are cleared whenever the condition is no longer valid.

Parameters:

None	

Returns:

True - Interrupt is Enabled
False - Interrupt is Disabled

12.4.3.70 bool Inno3Pro_Read_Status_IsPinShort (void)

Reads bit 3 on Telemetry register Read10 - IS-pin Short Circuit Detected.

This function tells that IS-pin Short Circuit was triggered

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The READ10 telemetry registers are instantaneous and are cleared whenever the condition is no longer valid.

Parameters:

None	

Returns:

True - IS-pin Short Circuit Detected
False - No IS-pin Short Circuit

12.4.3.71 bool Inno3Pro_Read_Status_IsPinShort_AR (void)

Reads bit 12 on Telemetry register Read11 - IS-pin Short Circuit Auto Restart(AR)

This function tells that an Auto Restart happened because of IS-pin Short Circuit

Parameters:

None	

Returns:

True - IS-pin Short Circuit AR Occurred
False - No Fault

12.4.3.72 bool Inno3Pro_Read_Status_IsPinShort_LO (void)

Reads bit 4 on Telemetry register Read11 - IS-pin Short Circuit Latch Off (LO)

This function tells that Latch-Off mode happened because of IS-pin Short Circuit

Parameters:

None	

Returns:

True - IS-pin Short Circuit LO Occurred
False - No Fault

12.4.3.73 bool Inno3Pro_Read_Status_LatchOff (void)

Reads bit 7 on Telemetry register Read11 - Latch-Off (LO) Occurred.

This function tells that the power supply is in Latch-Off mode.

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An AC Input Reset is needed to bring back normal operation if the fault is no longer present.

Parameters:

None	

Returns:

True - Latch-Off (LO) Occurred
False - No Fault

12.4.3.74 bool Inno3Pro_Read_Status_OtpFault (void)

Reads bit 9 on Telemetry register Read10 - Over-Temperature Protection.

This function tells that Over-Temperature Protection was triggered

The READ10 telemetry registers are instantaneous and are cleared whenever the condition is no longer valid.

Parameters:

None	

Returns:

True - Over-Temperature Protection Enabled
False - Over-Temperature Protection Disabled

12.4.3.75 bool Inno3Pro_Read_Status_OutputDischarge (void)

Reads bit 13 on Telemetry register Read10 - Output Discharge.

This function tells the load(VBUS) has been discharged.

The READ10 telemetry registers are instantaneous and are cleared whenever the condition is no longer valid.

Parameters:

None	

Returns:

True - Discharge is Enabled
False - Discharge is Disabled

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12.4.3.76 bool Inno3Pro_Read_status_OutputShorCkt(void)

Reads bit 2 on Telemetry register Read 10 – Output Short Circuit Detected

This function tells that Output Short Circuit was triggered.
The READ10 telemetry registers are instantaneous and are cleared whenever the condition is no longer valid.

Parameters:

None	

Returns:

True – Output Short Circuit Detected
False – No Output Short Circuit

12.4.3.77 bool Inno3Pro_Read_status_OutputShortCkt_AR(void)

Reads bit 11 on Telemetry register READ11 – Output Short Circuit Auto Restart (AR)

This function tells that an Auto Restart happened because of Output Short Circuit

Parameters:

None	

Returns:

True – Output Short Circuit AR Occurred
False – No Fault

12.4.3.78 bool Inno3Pro_Read_Status_OV_AR (void)

Reads bit 10 on Telemetry register Read11 - Output Voltage OV Auto Restart(AR)

This function tells that an Auto Restart happened because of Output Voltage Overvoltage.

Parameters:

None	

Returns:

True - Output Voltage Overvoltage AR Occurred
False - No Fault

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12.4.3.79 bool Inno3Pro_Read_Status_OV_Fault (void)

Reads bit 0 on Telemetry register Read10 - Output Voltage OV Fault Comparator.

This function tells that Output Voltage has crossed the OV Fault Threshold Limit

The READ10 telemetry registers are instantaneous and are cleared whenever the condition is no longer valid.

Parameters:

None	

Returns:

True - Output Voltage OV Fault Detected
False - No Output Voltage OV Fault

12.4.3.80 bool Inno3Pro_Read_Status_OV_LO (void)

Reads bit 2 on Telemetry register Read11 - Output Voltage OV Latch Off (LO)

This function tells that Latch-Off mode happened because of Output Voltage Overvoltage

Parameters:

None	

Returns:

True - Output Voltage Overvoltage LO Occurred
False - No Fault

12.4.3.81 bool Inno3Pro_Read_Status_PsuOffCmd (void)

Reads bit 5 on Telemetry register Read11 - PSU Turn-Off Command Received.

This function tells that PSU was Turned off since PSU Turn-Off CMD was received

Parameters:

None	

Returns:

True - PSU Turn-Off Command Received
False - No Fault

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12.4.3.82 bool Inno3Pro_Read_Status_SystemReady (void)

Reads bit 14 on Telemetry register Read10 - System Ready Signal.

This function provides the current status when InnoSwitch3-Pro is ready to receive I2C commands

The READ10 telemetry registers are instantaneous and are cleared whenever the condition is no longer valid.

Parameters:

None	

Returns:

True - System is Ready

12.4.3.83 bool Inno3Pro_Read_Status_UV_AR (void)

Reads bit 9 on Telemetry register Read11 - Output Voltage UV Auto Restart(AR)

This function tells that an Auto Restart happened because of Output Voltage Undervoltage

Parameters:

None	

Returns:

True - Output Voltage Undervoltage AR Occurred
False - No Fault

12.4.3.84 bool Inno3Pro_Read_Status_UV_Fault (void)

Reads bit 1 on Telemetry register Read10 - Output Voltage UV Fault Comparator.

This function tells that Output Voltage has crossed the UV Fault Threshold Limit

The READ10 telemetry registers are instantaneous and are cleared whenever the condition is no longer valid.

Parameters:

None	

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Returns:

True - Output Voltage UV Fault Detected
False - No Output Voltage UV Fault

12.4.3.85 bool Inno3Pro_Read_Status_UV_LO (void)

Reads bit 1 on Telemetry register Read11 - Output Voltage UV Latch Off (LO)

This function tells that Latch-Off mode happened because of Output Voltage Undervoltage

Parameters:

None	

Returns:

True - Output Voltage Undervoltage LO Occurred
False - No Fault

12.4.3.86 bool Inno3Pro_Read_Status_Vout10pct (void)

Reads bit 4 on Telemetry register Read10 - VOUTADC > 1.1*Vout.

This function monitors the VOUT10PCT status to detect when to disable the Active bleeder when the BLEEDER function is being used to bleed the output voltage from high to low set point

The READ10 telemetry registers are instantaneous and are cleared whenever the condition is no longer valid.

Parameters:

None	

Returns:

True - 10% Bleeder Enabled
False - 10% Bleeder Disabled

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12.4.3.87 bool Inno3Pro_Read_Status_Vout2pct (void)

Reads bit 5 on Telemetry register Read10 - 2% Bleeder Enabled.

This function monitors the VOUT2PCT status to detect when to disable the Active bleeder. when the BLEEDER function is being used to bleed the output voltage from high to low set point

The InnoSwitch3-Pro automatically activates a weak current bleeder (>5mA) on the VOUT pin until the output voltage settles to less than 2% of the set regulation threshold.

The READ10 telemetry registers are instantaneous and are cleared whenever the condition is no longer valid.

Parameters:

None	

Returns:

True - 2% Bleeder Enabled
False - 2% Bleeder Disabled

12.4.3.88 uint8_t Inno3Pro_Read_UV_Fault_Response (void)

Reads the Telemetry register READ6 - Under voltage Fault Response.

This function provides the Undervoltage Fault Response setting that was programmed on the UVL Register

This determines the action that InnoSwitch3-Pro will take in response to an output Undervoltage fault

Parameters:

None	

Returns:

Under voltage Fault Response in Byte

12.4.3.89 uint8_t Inno3Pro_Read_UV_Fault_Timer (void)

Reads the Telemetry register READ6 - Undervoltage Timer.

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This function provides the Under voltage Timer setting that was programmed on the UVL Timer Register

Parameters:

None	

Returns:

Under voltage Timer in Byte

12.4.3.90 float Inno3Pro_Read_UV_Threshold (void)

Reads the Telemetry register Read2 - Under Voltage Threshold.

This function provides the Under Voltage setting that was programmed on the UVA Register

Parameters:

None	

Returns:

Under Voltage Threshold in Volts

12.4.3.91 bool Inno3Pro_Read_VbusSwitch (void)

Reads bit 14 on Telemetry register Read4 - VBUS Switch Enable.

This function provides the current status of the VBUS Switch

Parameters:

None	

Returns:

True - Vbus Switch is Enabled (Closed)
False - Vbus Switch is Disabled (Open)

12.4.3.92 float Inno3Pro_Read_Voltage_DAC (void)

Reads the Telemetry register Read15 - Voltage DAC.

This function is useful in determining if InnoSwitch3-Pro is operating in CC or CV Mode

Parameters:

None	

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Returns:
DAC Voltage Reading in Volts

12.4.3.93 float Inno3Pro_Read_Volts (void)

Reads the Telemetry register Read9 - Measured Output Voltage.

This function provides the actual measured output voltage.

The output voltage report back is in 12-bit format but the resolution depends on the output voltage range.

Parameters:

None	

Returns:
Voltage Reading in Volts

12.4.3.94 float Inno3Pro_Read_VoltsAverage (void)

Reads the Telemetry register Read14 - Average Output Voltage.

This function provides the average measured output voltage.
The average output voltage measurement is simply 16-samples rolling average of the READ9 (measured output voltage).
The output voltage report back is in 12-bit format but the resolution depends on the output voltage range.

Parameters:

None	

Returns:
Voltage Reading in Volts

12.4.3.95 uint8_t Inno3Pro_Read_Watchdog_Timer (void)

Reads the Telemetry register READ6 - Watchdog Timer.

This function provides the Watchdog Timer Timeout setting that was programmed on the Watchdog Timer Register

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Parameters:

None	

Returns:

Watchdog Timer Timeout in Byte

12.4.3.96 void Inno3Pro_Set_Register_CC (float fCc) [inline]

12.4.3.97 void Inno3Pro_Set_Register_CDC (float fCdc) [inline]

12.4.3.98 void Inno3Pro_Set_Register_CV (float fVout) [inline]

12.4.3.99 void Inno3Pro_Set_Register_OVA (float fOva) [inline]

12.4.3.100 void Inno3Pro_Set_Register_UVA (float fUva) [inline]

12.4.3.101 void Inno3Pro_Set_Register_UVL (float fUvl) [inline]

12.4.3.102 void Inno3Pro_Set_Register_VBEN (float fVben) [inline]

12.4.3.103 void Inno3Pro_Set_Register_VKP (float fVkp) [inline]

12.4.3.104 void Inno3Pro_Set_Rsense_Value (float fRsense)

12.4.3.105 uint16_t Inno3Pro_Telemetry (uint8_t ReadBack_Address)

Handles InnoSwitch3-Pro Common I2C Read Back Telemetry.

This function Reads the Specific InnoSwitch3-Pro Telemetry register

Precondition:

I2C_Read16() Driver should be already Configured and is able to Read I2C commands

Parameters:

ReadBack_Address	- Read Back Register Address

Returns:

Register Reading

12.4.3.106 void Inno3Pro_TurnOff_PSU (bool bEnable)

Turns off the power supply.

This function puts the device into latch off

Note:

AC power cycling is required to restart the power supply.

Parameters:

bEnable	- Value to Turn off the power supply

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Input Values:

False: Disable Turn Off
True : Enable Turn Off

Returns:

None

12.4.3.107 void Inno3Pro_Vbus_Switch_Control (bool bEnableVben)

Vbus Switch Control (VBEN Control)

Used to Enable or Disable Vbus Switch By Writing a value to VBEN Register. This also Contains computations for VBEN settings

Note:

When VBEN is Disabled, Watchdog is Enabled As Default so Watchdog Timer is needed to be Disabled again

Before Disabling the Vbus Switch, Output Voltage is carefully monitored to properly decide when to turn off the Vbus Switch.

When the Output Voltage is detected to be at a High Voltage setting (> 5V), the UV is first set to 3V and then CV is programmed to 5V. Transition time of High voltage to 5V may take some time(in ms).

Parameters:

fEnableVben	- Value to Enable VBEN

Input Values:

False: Disable VBEN
True : Enable VBEN

Returns:

None

12.4.3.108 void Inno3Pro_Write_Amps (float fSetPtCC)

Constant Current (CC) Control.

Used to update the Value of CC Register

Parameters:

fSetPtCC	- Constant Current (CC) Set Point Value

CC Range:

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20% to 100%

Returns:

None

12.4.3.109 void Inno3Pro_Write_Cable_Drop_Comp (float fSetPtCDC)

Cable Drop Compensation (CDC) Control.

Used to update the Value of CDC Register. Contains computations for CDC settings

Parameters:

fSetPtCDC	- Cable Drop Compensation (CDC) Set Point Value

CDC Range:

0 to 600 mv (in 50mv Step)

Returns:

None

12.4.3.110 void Inno3Pro_Write_CCSC_Fault_Response(uint16_t u16Response)

12.4.3.111 Output Short Circuit Fault Response Setting.

12.4.3.112 Defines how the device will respond to Output Short Circuit fault condition.

Note:

InnoSwitch3-Pro sets the CCSC fault register once the voltage across the IS pin resistor exceeds more than ~3 times the IS(VTH).

In applications where the output capacitance after the series bus-switch exceeds 100 mF, the response for CCSC should be set to No-Response for proper start-up and may be programmed back to Auto-restart during normal operation after the series bus-switch is closed.

Parameters:

u16Response	- Fault Response setting of the Device

Returns:

None

12.4.3.113 void Inno3Pro_Write_CV_Load (uint16_t u16Load)

Constant Voltage Load setting.

Optimization feature for CV type of Load

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Note:

The constant current regulation mode in the InnoSwitch3-Pro can be optimized for constant voltage (CV) type load required by the end application.

Enabling this command register reduces the output current ripple for CV load only. This setting should only be used if CV load must be supported.

Parameters:

u16Load	- Value of CV load Register

Returns:

None

12.4.3.114 void Inno3Pro_Write_CVOL_Fault_Response (uint16_t u16Response)

CV Only Fault Response Setting.

Defines how the device will respond to CV Only fault condition

Parameters:

u16Response	- Fault Response setting of the Device

Returns:

None

12.4.3.115 void Inno3Pro_Write_CVOL_Fault_Timer (uint16_t u16Timer)

CV Only Fault Timer Setting.

Defines the duration of how long the device will continue to operate before triggering CVOL fault

Parameters:

u16Timer	- Delay Time before fault is asserted

Returns:

None

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12.4.3.116 void Inno3Pro_Write_Interupt_Mask (uint16_t u16IntMask)

Interrupt Mask Setting.

This defines the setting of the Active interrupt reporting scheme on the SCL Pin.

Note:

The Interrupt Mask Register must be enabled for each of the individual fault conditions to activate this feature.

Once a fault occurs, the Interrupt Mask is reset and the particular faults of interest must be re-enabled to activate the SCL reporting scheme.

Parameters:

u16IntMask	- Interrupt Bit Mask Settings

Returns:

None

12.4.3.117 void Inno3Pro_Write_ISSC_Fault_Response (uint16_t u16Response, uint16_t u16Frequency)

IS Pin Short Fault Response Setting.

Defines how the device will respond to IS pin Short fault condition

Note:

ISSC fault is annunciated in the event the IS pin voltage does not exceed approximately 50% of the full constant-current threshold (ISV(TH)) with a switching frequency exceeding a programmed threshold. The switching frequency can be selected in a range from 30 to 60 kHz.

Parameters:

u16Response	- Fault Response setting of the Device u16Frequency - Switching frequency threshold

Returns:

None

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12.4.3.118 void Inno3Pro_Write_Loop_Speed1 (uint16_t u16LoopSpeed)

Loop Speed 1 Setting.

Optimization feature for Transient Response

Note:

If faster transient response is required in the application the InnoSwitch3-Pro includes command registers to reduce the time for low to high output voltage transitions.

Using values other than the default or recommended settings could lead to oscillatory behavior.

Parameters:

u16LoopSpeed	- Value of u16Loop Speed 1

Returns:

None

12.4.3.119 void Inno3Pro_Write_Loop_Speed2 (uint16_t u16LoopSpeed)

Loop Speed 2 Setting.

Optimization feature for Transient Response

Note:

If faster transient response is required in the application the InnoSwitch3-Pro includes command registers to reduce the time for low to high output voltage transitions.

Using values other than the default or recommended settings could lead to oscillatory behavior.

Parameters:

u16LoopSpeed	- Value of u16Loop Speed 2

Returns:

None

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12.4.3.120 void Inno3Pro_Write_OTP_Hysteresis (uint16_t u16Otp)

Over Temperature Setting.

Defines the temperature when bleeder can be re-enabled

Note:

As secondary controller die temperature increases beyond ~125 Degrees Celsius, the active VOUT pin bleeder function will be turned off. The bleeder will not be permitted to be re-enabled until the controller temperature falls below the programmable hysteresis value.

Parameters:

u16Otp	- Over Temperature Hysteresis Setting

Returns:

None

12.4.3.121 void Inno3Pro_Write_Over_Volts (float fSetPtOVA)

Over Voltage Protection.

Used to update the Value of OVA Register

Parameters:

fSetPtOVA	- Over Voltage (OVA) Set Point Value

OVA Range:

6.2V to 25 V (in 100mv Step)

Returns:

None

12.4.3.122 void Inno3Pro_Write_OVL_Fault_Response (uint16_t u16Response)

Over Voltage Fault Response Setting.

Defines how the device will respond to Over Voltage fault condition

Parameters:

u16Response	- Fault Response setting of the Device

Returns:

None

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12.4.3.123 void Inno3Pro_Write_Under_Volts (float fSetPtUVA)

Under Voltage Protection.

Used to update the Value of UVA Register

Parameters:

fSetPtUVA	- Over Voltage (UVA) Set Point Value

UVA Range:

3V to 24 V (in 100mv Step)

Returns:

None

12.4.3.124 void Inno3Pro_Write_UVL_Fault_Response (uint16_t u16Response)

Under Voltage Fault Response Setting.

Defines how the device will respond to Under Voltage fault condition

Parameters:

u16Response	- Fault Response setting of the Device

Returns:

None

12.4.3.125 void Inno3Pro_Write_UVL_Fault_Timer (uint16_t u16Timer)

Under Voltage Fault Timer Setting.

Defines the duration of how long the device will continue to operate before triggering UVL fault

Parameters:

u16Timer	- Delay Time before fault is asserted

Returns:

None

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12.4.3.126 bool Inno3Pro_Write_VI (float fSetPtCV, float fSetPtCC)

Output Voltage Control with Bleeder Control and Constant Current (CC) Control.

Used to update the Value of CV and CC Register.
Automatically computes for UVA and OVA settings

- OVA is 124% of CV Setpoint
- UVA is Fixed to 3V setting

UVL is set to "No Response" by this function when CV setting is lesser than 3.6V and UVL is set back to "Auto Restart" when CV setting crosses 3.6V. This UVL feature is optional and currently commented on the code.

This function stores the old values it received.
If the Input parameters is the same with the previous it will not execute the I2C Commands

Note:

Transition time of High voltage to Low voltage (e.g 20V to 5V at No load) may take some time(in ms). It is recommended that voltage updates using this function must only be done after the update request was finished. When this function is used but the voltage transition is not yet complete the incoming update will not be processed.

Parameters:

fSetPtCV	- Output Voltage Set Point Value

CV Range:

3 to 24 V (in 10mv Step)

Parameters:

fSetPtCC	- Constant Current (CC) Set Point Value

CC Range:

20% to 100%

Returns:

True - Update process complete
False - Update process not yet complete

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12.4.3.127 void Inno3Pro_Write_Volt_Peak (float fSetPtVpk)

Constant Output Power Voltage Threshold (VKP) Control.

Used to update the Value of VKP Register. Contains computations for VKP settings

Parameters:

fSetPtVpk	- Value to Enable VBEN VKP Range:

VKP Range:

5.3V to 24V (in 100mV step)

Returns:

None

12.4.3.128 void Inno3Pro_Write_Volts (float fSetPtCV)

Output Voltage Control without Bleeder Control.

Used to update the Value of CV Register

Parameters:

fSetPtCV	- Output Voltage Set Point Value

CV Range:

3 to 24 V (in 10mv Step)

Returns:

None

12.4.3.129 void Inno3Pro_Write_Watchdog_Timer (uint16_t u16Timer)

Watchdog Timer Setting.

Defines the duration of how long the device will continue to operate before triggering Watchdog fault

Parameters:

u16Timer	- Delay Time before fault is asserted

Returns:

None

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12.4.4 Variable Documentation

12.4.4.1	volatile float fInno3Pro_CC	= (float)(5.1)	[static]
12.4.4.2	volatile float fInno3Pro_CDC	= (float)(300)	[static]
12.4.4.3	volatile float fInno3Pro_CV	= (float)(5)	[static]
12.4.4.4	volatile float fInno3Pro_OVA	= (float)(6.2)	[static]
12.4.4.5	volatile float fInno3Pro_UVA	= (float)(3)	[static]
12.4.4.6	volatile float fInno3Pro_UVL	= (float)(0)	[static]
12.4.4.7	volatile float fInno3Pro_VBEN	= (float)(0)	[static]
12.4.4.8	volatile float fInno3Pro_VKP	= (float)(7)	[static]
12.4.4.9	volatile uint8_t u8_Buffer_BLEEDER[2]	={0}	
12.4.4.10	volatile uint8_t u8_Buffer_CC[2]	={0}	
12.4.4.11	volatile uint8_t u8_Buffer_CDC[2]	={0}	
12.4.4.12	volatile uint8_t u8_Buffer_CV[2]	={0}	
12.4.4.13	volatile uint8_t u8_Buffer_CVLOAD[2]	={0}	
12.4.4.14	volatile uint8_t u8_Buffer_CVO[2]	={0}	
12.4.4.15	volatile uint8_t u8_Buffer_CVOL[2]	={0}	
12.4.4.16	volatile uint8_t u8_Buffer_CVOL_TIMER[2]	={0}	
12.4.4.17	volatile uint8_t u8_Buffer_FAST_VI_CMD[2]	={0}	
12.4.4.18	volatile uint8_t u8_Buffer_INTERRUPT[2]	={0}	
12.4.4.19	volatile uint8_t u8_Buffer_ISSC[2]	={0}	
12.4.4.20	volatile uint8_t u8_Buffer_LoopSpeed1[2]	={0}	
12.4.4.21	volatile uint8_t u8_Buffer_LoopSpeed2[2]	={0}	
12.4.4.22	volatile uint8_t u8_Buffer_OTP[2]	={0}	
12.4.4.23	volatile uint8_t u8_Buffer_OVA[2]	={0}	
12.4.4.24	volatile uint8_t u8_Buffer_OVL[2]	={0}	
12.4.4.25	volatile uint8_t u8_Buffer_TURN_OFF_PSU[2]	={0}	
12.4.4.26	volatile uint8_t u8_Buffer_UVA[2]	={0}	
12.4.4.27	volatile uint8_t u8_Buffer_UVL[2]	={0}	
12.4.4.28	volatile uint8_t u8_Buffer_UVL_TIMER[2]	={0}	
12.4.4.29	volatile uint8_t u8_Buffer_VBEN[2]	={0}	
12.4.4.30	volatile uint8_t u8_Buffer_VDIS[2]	={0}	

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12.4.4.31 volatile uint8_t u8_Buffer_VKP[2] ={0}

12.4.4.32 volatile uint8_t u8_Buffer_WATCHDOG_TIMER[2] ={0}

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13 Revision History

Date	Author	Revision	Description & changes	Reviewed
01-Mar-18	CS	1.6	Initial Release	Apps and Mktg
14-Mar-18	CS	1.7	Implemented 150us I2C delay, Updated Control Functions	Apps and Mktg
19-Jul-18	CS	1.8	Support for all Write and Read functions	Apps and Mktg
3-Aug-18	RJ	1.9	Added Introduction on first page	Apps and Mktg
10-Aug-18	CS	2.0	Updated Functions Documentations	Apps and Mktg
21-May-19	CS	2.1	Updated Command Sequences and Documentations	Apps and Mktg
12-May-20	JV	2.2	Updated Functions and Documentations	Apps and Mktg

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