DAC

Functions in “DAC.h” are designed to handle 16bit DAC. Functions in “20bitDAC.c” are for 20bit DAC. They are similar only with different addresses and limits.

**dac\_CLR\_H**

This function clear all DAC channels to clear code.

Unipolar, No differential -- Zero code

Unipolar, Differential -- Mid-scale code

Bipolar, No differential -- Mid-scale code

Bipolar, Differential -- Mid-scale code

**dacInit**

This function initiate DAC to a known state.

### *Registers and init\_value part1*

|  |  |  |
| --- | --- | --- |
| **Name** | DAC\_SPICONFIG | DAC\_GENCONFIG |
| **Address** | 0x03 | 0x04 |
| **Initial Value** | 0x0086 | 0x3F00 |
| **Note** | Reserved (DB15-DB12: 0000)  TEMPALM disabled (DB11: 0)  DACBUSY disabled (DB10: 0)  CRCALM disabled (DB9: 0)  Reserved (DB8-DB7: 01)  SOFTTOGGLE disabled (DB6: 0)  DEVICE activated (DB5: 0)  CRC disabled (DB4: 0)  Streaming mode disabled (DB3: 0)  SDO operational (DB2: 1)  SDO update during SCK falling edge (DB1: 1)  Reserved (DB0: 0) | Reserved (DB15: 0)  Enable internal reference (DB14: 0)  Reserved (DB13-DB8: 111111)  Disable differential mode for all channels (DB7-DB0: 00000000) |

### *Registers and init\_value part2*

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Address** | **Initial Value** | **Note** |
| DAC\_RANGE0 | 0x0A | 0xAA9E | Set range for channel 15-12. +/-10V for channel 15 and 14. +/-2.5V for channel 12 (Bias offset). +/-2.5V for channel 13 (Bias). |
| DAC\_RANGE1 | 0x0B | 0xAAAA | Set range to +/-10V for channel 11-8 |
| DAC\_RANGE2 | 0x0C | 0xAAAA | Set range to +/-10V for channel 7-4 |
| DAC\_RANGE3 | 0x0D | 0xAEAA | Set range for channel 3-0. +/-10V for channel 3, 1 and 0. +/-2.5V for channel 2 (Z offset fine) |
| DAC\_PD | 0x09 | 0x0000 | Disable power down mode for all channels |

**bit20Init**

This function initiate 20bitDAC to a known state.

### *Registers and init\_value*

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | BIT20\_CLEARCODE | BIT20\_DAC | BIT20\_CONTROL |
| **Address** | 0x30 | 0x10 | 0x20 |
| **Initial Value** | 0x00080000 | 0x00080000 | 0x00000012 |
| **Note** | Initial clear code register to mid scale code | Initial DAC register to mid-scale code | Linear error compensation selected to 10V span (DB9-DB6: 0000)  SDO enabled (DB5: 0)  DAC register uses offset binary coding style (DB4: 1)  Tri-state mode disabled (DB3: 0)  GND clamp disabled (DB2: 0)  Internal amplifier powered down (DB1: 1)  All other data bits are reserved, need to be set to zero |

**dacRange**

This function received packed data from PC and change the corresponding channel output range.

The range of all 16 DAC channels are stored in dacrange variable. 16 range value are integrated into four 16 bit variables dacrange[0], dacrange[1], dacrange[2] and dacrange[3].

Note that every time bias range is changed, bias offset need to be re-initialized based on current bias range. The corresponding offset value is stored in offset variable.

### *Lastdac variable*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **DAC channel** | **Function** | **Initial value (V)** | **Initial range** | **Initial range value** | **Range variable** |
| 0 | X IN | 0 | -10 V to +10 V | 10 (0b1010) | dacrange[3] LSB 1~4 |
| 1 | X OFFSET | 0 | -10 V to +10 V | 10 (0b1010) | dacrange[3] LSB 5~8 |
| 2 | Z OFFSET FINE | 0 | -2.5 V to +2.5 V | 14 (0b1110) | dacrange[3] LSB 9~12 |
| 3 | Z OFFSET | 0 | -10 V to +10 V | 10 (0b1010) | dacrange[3] LSB 13~16 |
| 4 | ISET OFFSET | 0 | -10 V to +10 V | 10 (0b1010) | dacrange[2] LSB 1~4 |
| 5 | ISET | 0 | -10 V to +10 V | 10 (0b1010) | dacrange[2] LSB 5~8 |
| 6 | DAC6 | 0 | -10 V to +10 V | 10 (0b1010) | dacrange[2] LSB 9~12 |
| 7 | DAC7 | 0 | -10 V to +10 V | 10 (0b1010) | dacrange[2] LSB 13~16 |
| 8 | DAC8 | 0 | -10 V to +10 V | 10 (0b1010) | dacrange[1] LSB 1~4 |
| 9 | DAC9 | 0 | -10 V to +10 V | 10 (0b1010) | dacrange[1] LSB 5~8 |
| 10 | ZOUTER | 0 | -10 V to +10 V | 10 (0b1010) | dacrange[1] LSB 9~12 |
| 11 | DAC11 | 0 | -10 V to +10 V | 10 (0b1010) | dacrange[1] LSB 13~16 |
| 12 | BIAS OFFSET | 0 | -2.5 V to +2.5 V | 14 (0b1110) | dacrange[0] LSB 1~4 |
| 13 | BIAS | 0.1 | -5 V to +5 V | 9 (0b1001) | dacrange[0] LSB 5~8 |
| 14 | Y OFFSET | 0 | -10 V to +10 V | 10 (0b1010) | dacrange[0] LSB 9~12 |
| 15 | Y IN | 0 | -10 V to +10 V | 10 (0b1010) | dacrange[0] LSB 13~16 |

### *Dacrange variable*

|  |  |  |
| --- | --- | --- |
| **Variable** | **Initial value** | **Note** |
| dacrange[0] | 0xAA9E (0b 1010 1010 1001 1110) | Y IN +/-10V, Y OFFSET +/-10V, BIAS +/-5V, BIAS OFFSET +/-2.5V |
| dacrange[1] | 0xAAAA (0b 1010 1010 1010 1010) | DAC11 +/-10V, ZOUTER +/-10V, DAC9 +/-10V, DAC8 +/-10V |
| dacrange[2] | 0xAAAA (0b 1010 1010 1010 1010) | DAC7 +/-10V, DAC6 +/-10V, ISET +/-10V, ISET OFFSET +/-10V |
| dacrange[3] | 0xAEAA (0b 1010 1110 1010 1010) | X IN +/-10V, X OFFSET +/-10V, Z OFFSET FINE +/-10V, Z OFFSET +/-10V |

### *Output range of 16 channels*

|  |  |  |  |
| --- | --- | --- | --- |
| **DAC range value** | **Corresponding range** | **DAC range value** | **Corresponding range** |
| 0 (0000) | 0 to 5V | 9 (1001) | -5 V to +5 V |
| 1 (0001) | 0 to 10V | 12 (1100) | -20 V to +20 V |
| 2 (0010) | 0 to 20V | 14 (1110) | -2.5 V to +2.5 V |
| 4 (0100) | 0 to 40 V | 10 (1010) | -10 V to +10 V |