

Configuration of USB7002/USB705x

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1.0 INTRODUCTION

The USB7002/USB7050/USB7051/USB7052/USB7056 can be configured:

- Via SMBus during start-up configuration stage (SOC_CFG)
- Via SMBus during hub operational stages (during runtime)
- Via One-Time Programmable (OTP) memory
- Via a USB interface during hub operational stages (during runtime)
- Via an external Serial Peripheral Interface (SPI) Flash

SMBus Configuration: The hub may be configured via the SMBus slave interface during the hub's start-up configuration stage (or SOC_CFG). To hold the hub in the SOC_CFG stage, the CONFIG_STRAP pins must be set with the correct configuration mode (CONFIG1 for USB7002/USB7051/US7052/USB7056, and CONFIG1, 2, 3, or 5 for USB7050) and the SMBus slave clock and data pins must be sampled as 'high' (10k pull-up resistors to 3.3V recommended) at power-on or when RESET_N is deasserted. Once in the configuration stage, any of the registers may be reconfigured. The hub waits in SOC_CFG indefinitely until it receives the special Attach command.

After the hub has exited the SOC_CFG stage, the configuration registers may still be manipulated via SMBus. This may be useful for enabling an external SOC to control the hub's GPIOs or to check certain hub status registers.

OTP Memory: The hub's registers may be configured via the hub's internal OTP memory. Any register may be given a new default value. The OTP memory is 8 kB, and each bit within the OTP memory may be set once, but never cleared. The OTP commands are loaded sequentially, so it is possible to overwrite a previously programmed register setting by programming that register subsequently with a new value. The OTP memory may be programmed via the USB interface or via SMBus.

USB Interface: All registers are accessible from the USB host using vendor-specific commands issued to the hub's internal Hub Feature Controller device.

External SPI Memory Device: If a custom firmware image is being used and executed from an attached SPI memory device, the configuration registers may also be configured within the SPI image. This method mimics the OTP configuration method and is referred to as "pseudo-OTP."

1.1 Sections

This document includes the following topics:

- [Hub Operational Mode on page 3](#)
- [Register Map on page 4](#)
- [SMBus Configuration on page 93](#)
- [OTP Configuration on page 97](#)
- [Hub Product IDs on page 114](#)

1.2 References

The following documents should be referenced when using this application note. See your Microchip representative for availability.

- *USB7002 Data Sheet*
- *USB7050 Data Sheet*
- *USB7051 Data Sheet*
- *USB7052 Data Sheet*
- *USB7056 Data Sheet*
- *MPLAB® Connect Configuration Tool*
- *System Management Bus Specification, Version 1.0*

2.0 HUB OPERATIONAL MODE

2.1 Hub Configuration Stages

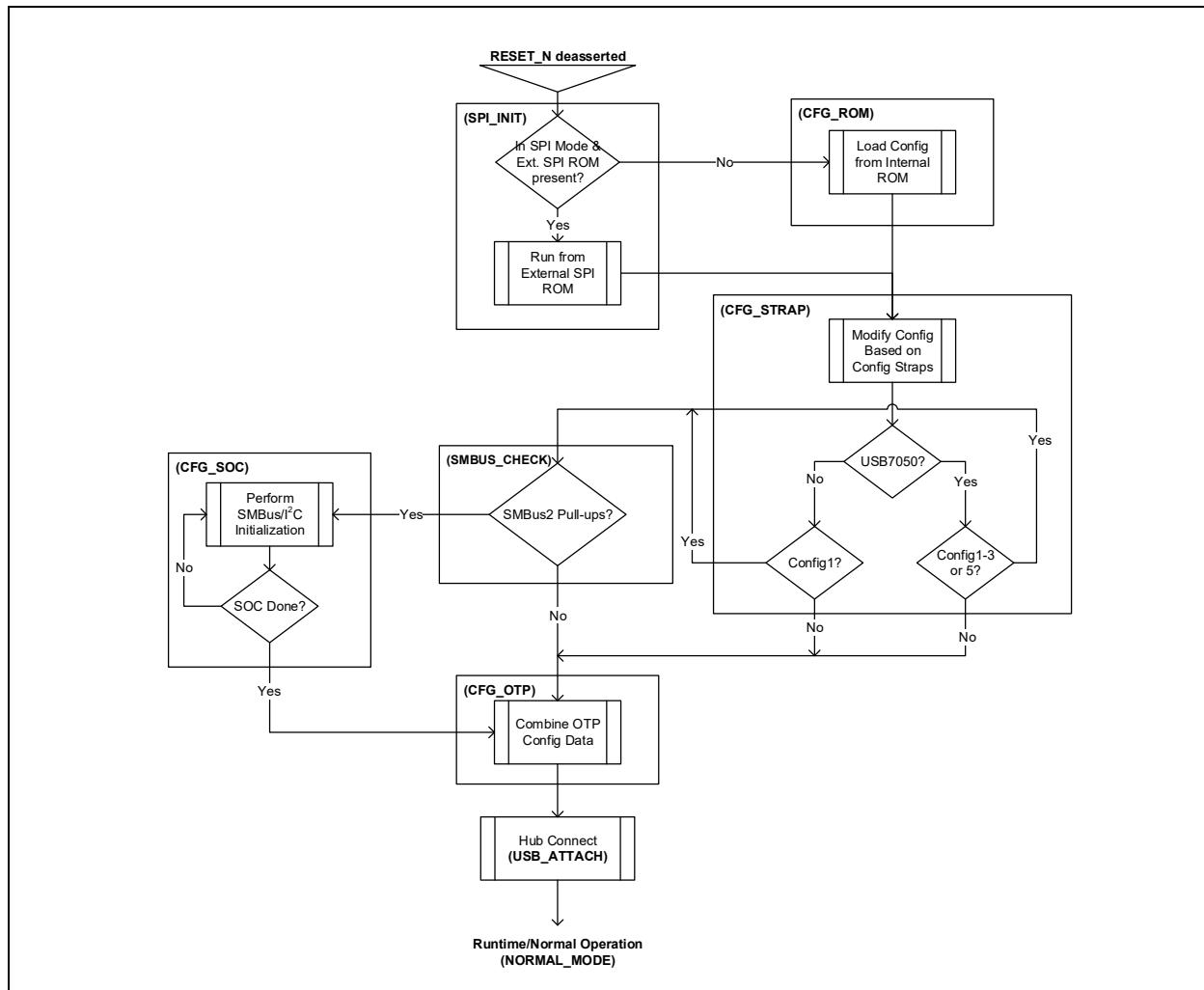
The hub is configured in three stages. The SOC_CFG stage is only entered if the CONFIG_STRAP pins are set with the correct configuration mode (CONFIG1 for USB7002/USB7051/US7052/USB7056, and CONFIG1, 2, 3, or 5 for USB7050) and the SMBus slave interface pins (data and clock) are both sampled as 'high' at start-up. During this stage, the hub allows an external SOC to configure the registers. The hub waits in SOC_CFG until it receives the special Attach command.

After SOC_CFG is complete (or if SOC_CFG is bypassed), the hub loads its OTP memory contents and manipulates the registers based on the OTP configuration.

Note: In the event that SMBus manipulates a register in the SOC_CFG stage and the same register is modified within the OTP memory, the configuration value as set within the OTP memory takes priority.

Figure 2-1 explains the hub start-up flow.

FIGURE 2-1: HUB CONFIGURATION OPERATIONAL MODE FLOWCHART



Note: Because the OTP configuration registers are loaded after the SOC_CFG stage, it is possible for configuration registers modified in the SOC_CFG stage to be overwritten in the CFG OTP stage. If a register is modified in both the SOC_CFG and OTP_CFG stages (an OTP patch was programmed to the hub OTP), then the register value as written in the OTP_CFG stage takes effect.

2.2 SMBus Protocol

The SMBus protocol is a flexible 2-pin serial protocol used for low-speed communication between integrated circuits. The protocol consists of an SMBCLK pin generated by the SMBus master and a bi-directional SMBDATA pin that can be driven by a master or a slave. The bus requires a pull-up resistor on both SMBCLK and SMBDATA to function. The hub configures the pins as Open/Drain buffers, where the driver either tristates the pin or drives the pin to GND. The input threshold for the high level ranges from 1.2V to 3.3V, allowing the hub to communicate with a large sample of SOCs on the market. Refer to the System Management Bus Specification for more details on the timing specifications of the bus.

3.0 REGISTER MAP

Note: It is recommended not to modify the current values of Reserved bits to avoid operation failure.

3.1 Configuration Registers (Base Address: BF80_0000h)

TABLE 3-1: CONFIGURATION REGISTERS MEMORY MAP

| Configuration Registers | | | Base Address: BF80_0000h | |
|-------------------------|-----|-----------|----------------------------------------|--------------------------|
| Offset | R/W | Name | Function | Modification Stage |
| 0800h | R | DEV_REV | Device Revision Register | Configuration |
| 0908h | R/W | PIO96_OEN | PIO[96:64] Output Enable Register | Runtime or Configuration |
| 0918h | R/W | PIO96_IEN | PIO[96:64] Input Enable Register | Runtime or Configuration |
| 0928h | R/W | PIO96_OUT | PIO[96:64] Output Register | Runtime or Configuration |
| 0938h | R/W | PIO96_IN | PIO[96:64] Input Register | Runtime or Configuration |
| 0948h | R/W | PIO96_PU | PIO[96:64] Pull-Up Resistor Register | Runtime or Configuration |
| 0958h | R/W | PIO96_PD | PIO[96:64] Pull-Down Resistor Register | Runtime or Configuration |
| 0968h | R/W | PIO96_OD | PIO[96:64] Open Drain Mode Register | Runtime or Configuration |
| 09E8h | R/W | PIO96_DEB | PIO[96:64] Debounce Register | Runtime or Configuration |
| 0C04h | R/W | PF1_CTL | Programmable Function 1 Control | Runtime or Configuration |
| 0C05h | R/W | PF2_CTL | Programmable Function 2 Control | Runtime or Configuration |
| 0C06h | R/W | PF3_CTL | Programmable Function 3 Control | Runtime or Configuration |
| 0C07h | R/W | PF4_CTL | Programmable Function 4 Control | Runtime or Configuration |
| 0C08h | R/W | PF5_CTL | Programmable Function 5 Control | Runtime or Configuration |
| 0C09h | R/W | PF6_CTL | Programmable Function 6 Control | Runtime or Configuration |
| 0C0Ah | R/W | PF7_CTL | Programmable Function 7 Control | Runtime or Configuration |
| 0C0Bh | R/W | PF8_CTL | Programmable Function 8 Control | Runtime or Configuration |
| 0C0Ch | R/W | PF9_CTL | Programmable Function 9 Control | Runtime or Configuration |

TABLE 3-1: CONFIGURATION REGISTERS MEMORY MAP (CONTINUED)

| Configuration Registers | | | Base Address: BF80_0000h | |
|-------------------------|-----|----------|----------------------------------|--------------------------|
| Offset | R/W | Name | Function | Modification Stage |
| 0C0Dh | R/W | PF10_CTL | Programmable Function 10 Control | Runtime or Configuration |
| 0C0Eh | R/W | PF11_CTL | Programmable Function 11 Control | Runtime or Configuration |
| 0C0Fh | R/W | PF12_CTL | Programmable Function 12 Control | Runtime or Configuration |
| 0C10h | R/W | PF13_CTL | Programmable Function 13 Control | Runtime or Configuration |
| 0C11h | R/W | PF14_CTL | Programmable Function 14 Control | Runtime or Configuration |
| 0C12h | R/W | PF15_CTL | Programmable Function 15 Control | Runtime or Configuration |
| 0C13h | R/W | PF16_CTL | Programmable Function 16 Control | Runtime or Configuration |
| 0C14h | R/W | PF17_CTL | Programmable Function 17 Control | Runtime or Configuration |
| 0C15h | R/W | PF18_CTL | Programmable Function 18 Control | Runtime or Configuration |
| 0C16h | R/W | PF19_CTL | Programmable Function 19 Control | Runtime or Configuration |
| 0C17h | R/W | PF20_CTL | Programmable Function 20 Control | Runtime or Configuration |
| 0C18h | R/W | PF21_CTL | Programmable Function 21 Control | Runtime or Configuration |
| 0C19h | R/W | PF22_CTL | Programmable Function 22 Control | Runtime or Configuration |
| 0C1Ah | R/W | PF23_CTL | Programmable Function 23 Control | Runtime or Configuration |
| 0C1Bh | R/W | PF24_CTL | Programmable Function 24 Control | Runtime or Configuration |
| 0C1Ch | R/W | PF25_CTL | Programmable Function 25 Control | Runtime or Configuration |
| 0C1Dh | R/W | PF26_CTL | Programmable Function 26 Control | Runtime or Configuration |
| 0C1Eh | R/W | PF27_CTL | Programmable Function 27 Control | Runtime or Configuration |
| 0C1Fh | R/W | PF28_CTL | Programmable Function 28 Control | Runtime or Configuration |
| 0C20h | R/W | PF29_CTL | Programmable Function 29 Control | Runtime or Configuration |
| 0C21h | R/W | PF30_CTL | Programmable Function 30 Control | Runtime or Configuration |
| 0C22h | R/W | PF31_CTL | Programmable Function 31 Control | Runtime or Configuration |
| 3000h | R/W | VID_LSB | Vendor ID LSB | Configuration |
| 3001h | R/W | VID_MSB | Vendor ID MSB | Configuration |
| 3002h | R/W | PID_LSB | Product ID LSB | Configuration |
| 3003h | R/W | PID_MSB | Product ID MSB | Configuration |
| 3004h | R/W | DID_LSB | Device ID LSB | Configuration |
| 3005h | R/W | DID_MSB | Device ID MSB | Configuration |

TABLE 3-1: CONFIGURATION REGISTERS MEMORY MAP (CONTINUED)

| Configuration Registers | | | Base Address: BF80_0000h | |
|-------------------------|-----|---------------------|---------------------------------------------------|--------------------------|
| Offset | R/W | Name | Function | Modification Stage |
| 3006h | R/W | HUB_CFG1 | Hub Configuration Data Byte 1 | Configuration |
| 3007h | R/W | HUB_CFG2 | Hub Configuration Data Byte 2 | Configuration |
| 3008h | R/W | HUB_CFG3 | Hub Configuration Data Byte 3 | Configuration |
| 3009h | R/W | HUB_NRD | Hub Non-Removable Device | Configuration |
| 300Ah | R/W | PORT_DIS_S | Port Disable - Self Powered | Configuration |
| 300Bh | R/W | PORT_DIS_B | Port Disable - Bus Powered | Configuration |
| 300Ch | R/W | H_MAXP_S | Hub Max Power - Self Powered | Configuration |
| 300Dh | R/W | H_MAXP_B | Hub Max Power - Bus Powered | Configuration |
| 300Eh | R/W | HC_MAXP_S | Hub Feature Controller Max Current - Self Powered | Configuration |
| 300Fh | R/W | HC_MAXP_B | Hub Feature Controller Max Current - Bus Powered | Configuration |
| 3010h | R/W | PWR_ON_TIME | Power-On Time Register | Configuration |
| 3013h | R/W | MFR_STR_INDEX | Manufacturer String Index Register | Configuration |
| 3014h | R/W | PRD_STR_INDEX | Product String Index Register | Configuration |
| 3015h | R/W | SER_STR_INDEX | Serial String Index Register | Configuration |
| 30D0h | R | BC_EN | Battery Charging Enable Status Register | Runtime (Hub) |
| 30E1h | R/W | OCS_LOCKOUT | Start OCS Lockout Timer Register | Configuration |
| 30E5h | R | PORT_PWR_STAT | Port Power Status | Runtime (Hub) |
| 30E6h | R | USB2_TEST_MODE | USB2 Test Mode Register | Runtime or Configuration |
| 30E7h | R/W | HS_TRESP_TIMEOUT | LPM Turnaround Timeout | Configuration |
| 30E9h | R/W | ENABLE_OCS_LEGACY | Enable OCS Legacy Register | Configuration |
| 30EAh | R/W | OCS_MIN_WIDTH | OCS Minimum Width Register | Configuration |
| 30EBh | R/W | OCS_INACTIVE_TIMER | OCS Inactive Timer | Configuration |
| 30FAh | R/W | HUB_PRT_SWAP | Hub Port Swap Register | Configuration |
| 30FBh | R/W | HUB_PRT_REMAP_12 | Hub Port Remap 1-2 Register | Configuration |
| 30FCh | R/W | HUB_PRT_REMAP_34 | Hub Port Remap 3-4 Register | Configuration |
| 30FDh | R/W | HUB_PRT_REMAP_56 | Hub Port Remap 5-6 Register | Configuration |
| 30FEh | R/W | HUB_PRT_REMAP_7 | Hub Port Remap 7 Register | Configuration |
| 3100h | R | USB2_LINK_STATE1 | USB2 Link State Port 0-3 | Runtime (Hub) |
| 3101h | R | USB2_LINK_STATE2 | USB2 Link State Port 4-7 | Runtime (Hub) |
| 3104h | R/W | USB2_HUB_CTL | USB2 Hub Control | Runtime |
| 3108h | R/W | USB2_BCDUSB | USB2 Version BCD[15:0] | Configuration |
| 318Ch | R/W | CNTLP | Hub Control Portable Test | Runtime |
| 318Dh | R/W | EMBED_TEST_PORT_SEL | Embedded Hub Test Port Select | Runtime |
| 3194h | R | USB2_HUB_STAT | USB2 Hub Status Register | Runtime (Hub) |
| 3195h | R | USB2_DN_SPEED14 | USB2 Downstream Device Speed[4-1] | Runtime (Hub) |
| 3196h | R | USB2_DN_SPEED75 | USB2 Downstream Device Speed[7-5] | Runtime (Hub) |
| 3197h | R | USB2_SUSP_IND | USB2 Suspend Indicator | Runtime (Hub) |
| 3C00h | R/W | PORT_CFG_SEL_0 | PORT0 (Upstream) Port Power Select | Configuration |
| 3C04h | R/W | PORT_CFG_SEL_1 | PORT1 Port Power Select | Configuration |
| 3C08h | R/W | PORT_CFG_SEL_2 | PORT2 Port Power Select | Configuration |

TABLE 3-1: CONFIGURATION REGISTERS MEMORY MAP (CONTINUED)

| Configuration Registers | | | Base Address: BF80_0000h | |
|-------------------------|-----|-----------------|-----------------------------------|--------------------|
| Offset | R/W | Name | Function | Modification Stage |
| 3C0Ch | R/W | PORT_CFG_SEL_3 | PORT3 Port Power Select | Configuration |
| 3C10h | R/W | PORT_CFG_SEL_4 | PORT4 Port Power Select | Configuration |
| 3C14h | R/W | PORT_CFG_SEL_5 | PORT5 Port Power Select | Configuration |
| 3C18h | R/W | PORT_CFG_SEL_6 | PORT6 Port Power Select | Configuration |
| 3C20h | R/W | USB_OCS_SEL_1 | USB Port1 OCS Source Select | Configuration |
| 3C24h | R/W | USB_OCS_SEL_2 | USB Port2 OCS Source Select | Configuration |
| 3C28h | R/W | USB_OCS_SEL_3 | USB Port 3 OCS Source Select | Configuration |
| 3C2Ch | R/W | USB_OCS_SEL_4 | USB Port 4 OCS Source Select | Configuration |
| 3C30h | R/W | USB_OCS_SEL_5 | USB Port 5 OCS Source Select | Configuration |
| 3034h | R/W | USB_OCS_SEL_6 | USB Port 6 OCS Source Select | Configuration |
| 3038h | R/W | USB_OCS_SEL_7 | USB Port 7 OCS Source Select | Configuration |
| 3C40h | R/W | VBUS_PASS_THRU | VBUS_DET Pass Through Register | Configuration |
| 3C50h | R | PORT_STAT_REG_0 | Port 0 (Upstream) Status Register | Runtime |
| 3C54h | R | PORT_STAT_REG_1 | Port 1 Status Register | Runtime |
| 3C58h | R | PORT_STAT_REG_2 | Port 2 Status Register | Runtime |
| 3C5Ch | R | PORT_STAT_REG_3 | Port 3 Status Register | Runtime |
| 3C60h | R | PORT_STAT_REG_4 | Port 4 Status Register | Runtime |
| 3C64h | R | PORT_STAT_REG_5 | Port 5 Status Register | Runtime |
| 3C68h | R | PORT_STAT_REG_6 | Port 6 Status Register | Runtime |
| 3C6Ch | R | PORT_STAT_REG_7 | Port 7 Status Register | Runtime |
| 60CAh | R/W | HS_P0_BOOST | USB Port 0 Boost Register | Configuration |
| 60CCh | R/W | HS_P0_VSENSE | USB Port 0 VariSense Register | Configuration |
| 64CAh | R/W | HS_P1_BOOST | USB Port 1 Boost Register | Configuration |
| 64CCh | R/W | HS_P1_VSENSE | USB Port 1 VariSense Register | Configuration |
| 68CAh | R/W | HS_P2_BOOST | USB Port 2 Boost Register | Configuration |
| 68CCh | R/W | HS_P2_VSENSE | USB Port 2 VariSense Register | Configuration |
| 6CCAh | R/W | HS_P3_BOOST | USB Port 3 Boost Register | Configuration |
| 6CCCh | R/W | HS_P3_VSENSE | USB Port 3 VariSense Register | Configuration |
| 70CAh | R/W | HS_P4_BOOST | USB Port 4 Boost Register | Configuration |
| 70CCh | R/W | HS_P4_VSENSE | USB Port 4 VariSense Register | Configuration |
| 74CAh | R/W | HS_P5_BOOST | USB Port 5 Boost Register | Configuration |
| 74CCh | R/W | HS_P5_VSENSE | USB Port 5 VariSense Register | Configuration |

3.2 Configuration Registers (Base Address: BFD2_0000h)

TABLE 3-2: CONFIGURATION REGISTERS MEMORY MAP

| Configuration Registers | | | Base Address: BFD2_0000h | |
|-------------------------|-----|-------------------|--------------------------------------|--------------------------------|
| OFFSET | R/W | Name | Function | Recommended Modification Stage |
| 2856h | R/W | HFC_PID_LSB | HFC Product ID LSB | Configuration |
| 2857h | R/W | HFC_PID_MSB | HFC Product ID MSB | Configuration |
| 3202h | R/W | LANG_ID | LANG_ID[15:0] Language Identifier | Configuration |
| 3204h | R/W | MFG_STR | Manufacturer String Descriptor | Configuration |
| 3244h | R/W | PROD_STR | Product String Descriptor | Configuration |
| 3400h | R/W | RUNTIME_FLAGS | Runtime Flags Memory | Runtime or Configuration |
| 3408h | R/W | RUNTIME_FLAGS2 | Runtime Flags 2 Memory | Runtime or Configuration |
| 3412h | R/W | I2S_FEAT_SEL | I2S Feature Select Register | Configuration |
| 3413h | R/W | I2S_HFEAT_SEL | I2S HID Feature Select Register | Configuration |
| 3419h | R/W | SMBUS OTP RES | SMBUS OTP Result | Configuration |
| 341Bh | R/W | OTP_UDC_ENABLE | OTP UDC Enumeration | Configuration |
| 341Eh | R/W | HUB_DEF_PIDM | Hub PID MSB | Configuration |
| 341Fh | R/W | HUB_DEF_PIDL | Hub PID LSB | Configuration |
| 3433h | R/W | BC_CONFIG_P1 | Port1 Battery Charging Configuration | Configuration |
| 3434h | R/W | BC_CONFIG_P2 | Port2 Battery Charging Configuration | Configuration |
| 3435h | R/W | BC_CONFIG_P3 | Port3 Battery Charging Configuration | Configuration |
| 3436h | R/W | BC_CONFIG_P4 | Port4 Battery Charging Configuration | Configuration |
| 3437h | R/W | BC_CONFIG_P5 | Port5 Battery Charging Configuration | Configuration |
| 3438h | R/W | BC_CONFIG_P6 | Port6 Battery Charging Configuration | Configuration |
| 3442h | R/W | FLEX_IN_PORT1 | FLEX_IN_Port1 | Configuration |
| 3443h | R/W | FLEX_IN_PORT2 | FLEX_IN_Port2 | Configuration |
| 3444h | R/W | FLEX_IN_PORT3 | FLEX_IN_Port3 | Configuration |
| 3445h | R/W | FLEX_IN_PORT4 | FLEX_IN_Port4 | Configuration |
| 3446h | R/W | FLEX_IN_PORT5 | FLEX_IN_Port5 | Configuration |
| 3447h | R/W | FLEX_IN_PORT6 | FLEX_IN_Port6 | Configuration |
| 3448h | R/W | FLEX_OUT_PORT1 | FLEX_OUT_Port1 | Configuration |
| 3449h | R/W | FLEX_OUT_PORT2 | FLEX_OUT_Port2 | Configuration |
| 344Ah | R/W | FLEX_OUT_PORT3 | FLEX_OUT_Port3 | Configuration |
| 344Bh | R/W | FLEX_OUT_PORT4 | FLEX_OUT_Port4 | Configuration |
| 344Ch | R/W | FLEX_OUT_PORT5 | FLEX_OUT_Port5 | Configuration |
| 344Dh | R/W | FLEX_OUT_PORT6 | FLEX_OUT_Port6 | Configuration |
| 344Eh | R/W | FLEX_PRTCTL_PORT1 | FLEX_PRTCTL_Port1 | Configuration |
| 344Fh | R/W | FLEX_PRTCTL_PORT2 | FLEX_PRTCTL_Port2 | Configuration |
| 3450h | R/W | FLEX_PRTCTL_PORT3 | FLEX_PRTCTL_Port3 | Configuration |
| 3451h | R/W | FLEX_PRTCTL_PORT4 | FLEX_PRTCTL_Port4 | Configuration |

TABLE 3-2: CONFIGURATION REGISTERS MEMORY MAP (CONTINUED)

| Configuration Registers | | | Base Address: BFD2_0000h | | Recommended Modification Stage |
|-------------------------|-----|-------------------|------------------------------|--|--------------------------------|
| OFFSET | R/W | Name | Function | | |
| 3452h | R/W | FLEX_PRTCTL_PORT5 | FLEX_PRTCTL_Port5 | | Configuration |
| 3453h | R/W | FLEX_PRTCTL_PORT6 | FLEX_PRTCTL_Port6 | | Configuration |
| 3454h | R/W | FLEX_VBUSDET | FLEX_VBUSDET | | Configuration |
| 3455h | R/W | FLEX_ATTACH_DELAY | FlexConnect Hub Attach Delay | | Configuration |
| 3456h | R/W | ROLE_SWITCH_DELAY | Role Switch Delay | | Configuration |
| 346Ah | R/W | MFG_STR_LEN | Manufacturer String Length | | Configuration |
| 3472h | R/W | PROD_STR_LEN | Product String Length | | Configuration |

3.3 PFx Function/Pin Number/PIO Register Mapping

TABLE 3-3: PFX TO PIN NUMBER AND PIO REGISTER MAPPING

| PFx | USB7002 | USB7050 | USB7051 | USB7052 | USB7056 | PIO | Register |
|------|---------|---------|---------|---------|---------|--------|-----------|
| | Pin # | | |
| PF2 | | 43 | | | | GPIO66 | PIO96[2] |
| PF3 | | 44 | | | | GPIO67 | PIO96[3] |
| PF4 | | 45 | 45 | | | GPIO68 | PIO96[4] |
| PF5 | | 56 | | | | GPIO69 | PIO96[5] |
| PF6 | 47 | 47 | 47 | 47 | 47 | GPIO70 | PIO96[6] |
| PF7 | 48 | 48 | 48 | 48 | 48 | GPIO71 | PIO96[7] |
| PF10 | | | | | 51 | GPIO74 | PIO96[10] |
| PF11 | | | | | 51 | GPIO75 | PIO96[11] |
| PF12 | 54 | | | | | GPIO76 | PIO96[12] |
| PF14 | 57 | 57 | 57 | 57 | | GPIO78 | PIO96[14] |
| PF18 | 61 | | | | | GPIO82 | PIO96[18] |
| PF19 | 66 | 66 | 66 | 66 | | GPIO83 | PIO96[19] |
| PF26 | 75 | 75 | 75 | 75 | | GPIO90 | PIO96[26] |
| PF27 | 76 | 76 | 76 | 76 | | GPIO91 | PIO96[27] |
| PF28 | 77 | 77 | 77 | 77 | | GPIO92 | PIO96[28] |
| PF29 | 74 | 74 | 74 | 74 | | GPIO93 | PIO96[29] |
| PF30 | 2 | 2 | 2 | | | GPIO94 | PIO96[30] |
| PF31 | 3 | 3 | 3 | | | GPIO95 | PIO96[31] |

3.3.1 REGISTER DEFINITIONS

TABLE 3-4: DEVICE REVISION REGISTER

| | | | |
|---------------------------------------------------------------------|----------|---|--------------------------------------------------------------------|
| DEV_REV OFFSET: 0800h RESET = B000_8D01H | | | Device Revision Register Base Address: BF80_0000h |
| | | | Description |
| 31:16 | DEVID | R | Device ID: 8D01h |
| 15:8 | Reserved | R | Always reads 0 |
| 7:0 | REVID | R | Silicon Revision ID A0h = A0 silicon B0h = B0 silicon |

Note: 0800h-[7:0], 0801h-[15:8], 0802h-[23:16], 0803h-[31:24]

TABLE 3-5: PIO[96:64] OUTPUT ENABLE REGISTER

| | | | |
|-----------------------------------------------------------------------|------------------|-----|------------------------------------------------------------------------|
| PIO96_OEN OFFSET: 0908h RESET = 0000_0000h | | | PIO96 Output Enable Register Base Address: BF80_0000h |
| | | | Description |
| 31:0 | PIO96_OEN[96:64] | R/W | PIO96_OEN[x] 0 = Disabled 1 = Enabled |

Note: 0908h-[7:0], 0909h-[15:8], 090Ah-[23:16], 090Bh-[31:24]

TABLE 3-6: PIO[96:64] INPUT ENABLE REGISTER

| | | | |
|-----------------------------------------------------------------------|------------------|-----|-----------------------------------------------------------------------|
| PIO96_IEN OFFSET: 0918h RESET = 0000_0000h | | | PIO96 Input Enable Register Base Address: BF80_0000h |
| | | | Description |
| 31:0 | PIO96_IEN[96:64] | R/W | PIO96_IEN[x] 0 = Disabled 1 = Enabled |

Note: 0918h-[7:0], 0919h-[15:8], 092Ah-[23:16], 092Bh-[31:24]

TABLE 3-7: PIO[96:64] OUTPUT REGISTER

| | | | |
|-----------------------------------------------------------------------|------------------|-----|-----------------------------------------------------------------|
| PIO96_OUT OFFSET: 0928h RESET = 0000_0000h | | | PIO96 Output Register Base Address: BF80_0000h |
| | | | Description |
| 31:0 | PIO96_OUT[96:64] | R/W | PIO96_OUT[x] 0 = Output is 0 1 = Output is 1 |

Note: 0928h-[7:0], 0929h-[15:8], 093Ah-[23:16], 093Bh-[31:24]

TABLE 3-8: PIO[96:64] INPUT REGISTER

| PIO96_IN OFFSET: 0938h RESET = 0000_0000h | | | PIO96 Input Register Base Address: BF80_0000h |
|-------------------------------------------------|-----------------|-----|--------------------------------------------------|
| Bit | Name | R/W | Description |
| 31:0 | PIO96_IN[96:64] | R/W | PIO96_IN[x] 0 = Input is 0 1 = Input is 1 |

Note: 0938h-[7:0], 0939h-[15:8], 094Ah-[23:16], 094Bh-[31:24]

TABLE 3-9: PIO[96:64] PULL-UP RESISTOR REGISTER

| PIO96_PU OFFSET: 0948h RESET = 0000_0000h | | | PIO96 Pull-Up Register Base Address: BF80_0000h |
|-------------------------------------------------|-----------------|-----|------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 31:0 | PIO96_PU[96:64] | R/W | PIO96_PU[x] 0 = Pull-Up Disabled 1 = Pull-Up Enabled |

Note: 0948h-[7:0], 0949h-[15:8], 095Ah-[23:16], 095Bh-[31:24]

TABLE 3-10: PIO[96:64] PULL-DOWN RESISTOR REGISTER

| PIO96_PD OFFSET: 0958h RESET = 0000_0000h | | | PIO96 Pull-Down Register Base Address: BF80_0000h |
|-------------------------------------------------|-----------------|-----|----------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 31:0 | PIO96_PD[96:64] | R/W | PIO96_PD[x] 0 = Pull-Down Disabled 1 = Pull-Down Enabled |

Note: 0958h-[7:0], 0959h-[15:8], 096Ah-[23:16], 096Bh-[31:24]

TABLE 3-11: PIO[96:64] OPEN DRAIN MODE REGISTER

| PIO96_OD OFFSET: 0968h RESET = 0000_0000h | | | PIO96 Open Drain Mode Register Base Address: BF80_0000h |
|-------------------------------------------------|-----------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 31:0 | PIO96_OD[96:64] | R/W | PIO96_OD[x] 0 = Open Drain Disabled 1 = Open Drain Enabled If bit is 1 and the corresponding output is enabled { If output register is 1, output is Hi-Z unless pull-up is enabled. If output register is 0, output is 0.} |

Note: 0968h-[7:0], 0969h-[15:8], 097Ah-[23:16], 097Bh-[31:24]

TABLE 3-12: PIO[96:64] DEBOUNCE REGISTER

| PIO96_DEB OFFSET: 09E8h RESET = 0000_0000h | | | PIO96 Debounce Register Base Address: BF80_0000h |
|---------------------------------------------------------|------------------|-----|--------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 31:0 | PIO96_DEB[96:64] | R/W | PIO96_DEB[x] 0 = No debounce 1 = Input debounced as specified in GPIO_DEBOUNCE |

Note: 09E8h-[7:0], 09E9h-[15:8], 09EAh-[23:16], 09EBh-[31:24]

TABLE 3-13: PROGRAMMABLE FUNCTION 1 CONTROL

| PF1_CTL OFFSET: 0C04h RESET = 0000_0000h | | | PF1 Control Register Base Address: BF80_0000h |
|-------------------------------------------------------|----------|-----|---------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO65 |

TABLE 3-14: PROGRAMMABLE FUNCTION 2 CONTROL

| PF2_CTL OFFSET: 0C05h RESET = 0000_0000h | | | PF2 Control Register Base Address: BF80_0000h |
|-------------------------------------------------------|----------|-----|---------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO66 001 - Reserved 010 - UART_nCTS 011 - DP1_VCONN1 100 - UART_nDSR 101 - PD_SPI_CE_N4 110 - I2S_SDO |

TABLE 3-15: PROGRAMMABLE FUNCTION 3 CONTROL

| PF3_CTL OFFSET: 0C06h RESET = 0000_0000h | | | PF3 Control Register Base Address: BF80_0000h |
|-------------------------------------------------------|----------|-----|--------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO67 001 - I2S_SDI 010 - UART_nRTS 011 - DP1_VCONN2 100 - PD_SPI_CE_N3 |

TABLE 3-16: PROGRAMMABLE FUNCTION 4 CONTROL

| PF4_CTL OFFSET: 0C07h RESET = 0000_0000h | | | PF4 Control Register Base Address: BF80_0000h |
|------------------------------------------------|----------|-----|-------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO68 001 - I2S_SDO 010 - UART_nDSR 011 - DP3_DISCHARGE 100 - PD_SPI_CE_N2 101 - DP1_VCONN1 |

TABLE 3-17: PROGRAMMABLE FUNCTION 5 CONTROL

| PF5_CTL OFFSET: 0C08h RESET = 0000_0000h | | | PF5 Control Register Base Address: BF80_0000h |
|------------------------------------------------|----------|-----|-----------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO69 001 - I2S_SCK 010 - UART_nDTR 011 - DP1_DISCHARGE 100 - PD_SPI_CE_N1 |

TABLE 3-18: PROGRAMMABLE FUNCTION 6 CONTROL

| PF6_CTL OFFSET: 0C09h RESET = 0000_0000h | | | PF6 Control Register Base Address: BF80_0000h |
|------------------------------------------------|----------|-----|-------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO70 001 - I2S_LRCK 010 - UART_RX 011 - DP1_DISCHARGE 100 - PD_SPI_CE_N0 101 - PRT_CTL1_U3 |

TABLE 3-19: PROGRAMMABLE FUNCTION 7 CONTROL

| PF7_CTL OFFSET: 0C0Ah RESET = 0000_0000h | | | PF7 Control Register Base Address: BF80_0000h |
|-------------------------------------------------------|----------|-----|-----------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO71 001 - I2S_MCLK 010 - UART_TX 011 - DP1_DISCHARGE 100 - PD_SPI_CLK 101 - PRT_CTL2_U3 |

TABLE 3-20: PROGRAMMABLE FUNCTION 8 CONTROL

| PF8_CTL OFFSET: 0C0Bh RESET = 0000_0000h | | | PF8 Control Register Base Address: BF80_0000h |
|-------------------------------------------------------|----------|-----|--------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO72 001 - PD_I2C_DATA 010 - Reserved 011 - DP1_VCONN1 100 - PD_SPI_DO |

TABLE 3-21: PROGRAMMABLE FUNCTION 9 CONTROL

| PF9_CTL OFFSET: 0C0Ch RESET = 0000_0000h | | | PF9 Control Register Base Address: BF80_0000h |
|-------------------------------------------------------|----------|-----|-------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO73 001 - PD_I2C_CLK 010 - Reserved 011 - DP1_VCONN2 100 - PD_SPI_DI |

TABLE 3-22: PROGRAMMABLE FUNCTION 10 CONTROL

| PF10_CTL OFFSET: 0C0Dh RESET = 0000_0000h | | | PF10 Control Register Base Address: BF80_0000h |
|--------------------------------------------------------|----------|-----|---------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO74 001 - MSTR_I2C_DATA 010 - PRT_CTL3_U3 011 - DP3_VCONN1 100 - PD_SPI_CE_N5 101 - I2S_SDI |

TABLE 3-23: PROGRAMMABLE FUNCTION 11 CONTROL

| PF11_CTL OFFSET: 0C0Eh RESET = 0000_0000h | | | PF11 Control Register Base Address: BF80_0000h |
|-------------------------------------------------|----------|-----|---------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO75 001 - MSTR_I2C_CLK 010 - PRT_CTL4_U3 011 - DP3_VCONN2 100 - PD_SPI_CE_N6 101 - I2S_MCLK |

TABLE 3-24: PROGRAMMABLE FUNCTION 12 CONTROL

| PF12_CTL OFFSET: 0C0Fh RESET = 0000_0000h | | | PF12 Control Register Base Address: BF80_0000h |
|-------------------------------------------------|----------|-----|---------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO76 001 - PRT_CTL5_U3 |

TABLE 3-25: PROGRAMMABLE FUNCTION 13 CONTROL

| PF13_CTL OFFSET: 0C10h RESET = 0000_0000h | | | PF13 Control Register Base Address: BF80_0000h |
|-------------------------------------------------|----------|-----|----------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO77 001 - PRT_CTL5/OCS 010 - PRT_CTL4/OCS |

TABLE 3-26: PROGRAMMABLE FUNCTION 14 CONTROL

| PF14_CTL OFFSET: 0C11h RESET = 0000_0000h | | | PF14 Control Register Base Address: BF80_0000h |
|-------------------------------------------------|----------|-----|------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO78 001 - I2S_SDI 010 - UART_nCTS 011 - PRT_CTL4/OCS 100 - MSTR_I2C_CLK 101 - UART_nRTS 110 - UART_nDTR |

TABLE 3-27: PROGRAMMABLE FUNCTION 15 CONTROL

| PF15_CTL OFFSET: 0C12h RESET = 0000_0000h | | | PF15 Control Register Base Address: BF80_0000h |
|--------------------------------------------------------|----------|-----|----------------------------------------------------------|
| | | | |
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO79 001 - PRT_CTL3/OCS |

TABLE 3-28: PROGRAMMABLE FUNCTION 16 CONTROL

| PF16_CTL OFFSET: 0C13h RESET = 0000_0000h | | | PF16 Control Register Base Address: BF80_0000h |
|--------------------------------------------------------|----------|-----|----------------------------------------------------------|
| | | | |
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO80 001 - PRT_CTL2/OCS |

TABLE 3-29: PROGRAMMABLE FUNCTION 17 CONTROL

| PF17_CTL OFFSET: 0C14h RESET = 0000_0000h | | | PF17 Control Register Base Address: BF80_0000h |
|--------------------------------------------------------|----------|-----|----------------------------------------------------------|
| | | | |
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO81 001 - PRT_CTL1/OCS |

TABLE 3-30: PROGRAMMABLE FUNCTION 18 CONTROL

| PF18_CTL OFFSET: 0C15h RESET = 0000_0000h | | | PF18 Control Register Base Address: BF80_0000h |
|--------------------------------------------------------|----------|-----|-------------------------------------------------------------------------------------------|
| | | | |
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO82 001 - I2S_LRCK 010 - UART_nDCD 011 - Reserved 100 - MSTR_I2C_CLK |

TABLE 3-31: PROGRAMMABLE FUNCTION 19 CONTROL

| PF19_CTL OFFSET: 0C16h RESET = 0000_0000h | | | PF19 Control Register Base Address: BF80_0000h |
|--------------------------------------------------------|----------|-----|-----------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO83 001 - I2S_SDO 010 - UART_nRTS 011 - SLV_I2C_DATA 100 - MSTR_I2C_DATA |

TABLE 3-32: PROGRAMMABLE FUNCTION 20 CONTROL

| PF20_CTL OFFSET: 0C17h RESET = 0000_0000h | | | PF20 Control Register Base Address: BF80_0000h |
|--------------------------------------------------------|----------|-----|----------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO84 001 - SPI_CE_N |

TABLE 3-33: PROGRAMMABLE FUNCTION 21 CONTROL

| PF21_CTL OFFSET: 0C18h RESET = 0000_0000h | | | PF21 Control Register Base Address: BF80_0000h |
|--------------------------------------------------------|----------|-----|----------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO85 001 - SPI_CLK |

TABLE 3-34: PROGRAMMABLE FUNCTION 22 CONTROL

| PF22_CTL OFFSET: 0C19h RESET = 0000_0000h | | | PF22 Control Register Base Address: BF80_0000h |
|--------------------------------------------------------|----------|-----|----------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO86 001 - SPI_D0 |

TABLE 3-35: PROGRAMMABLE FUNCTION 23 CONTROL

| PF23_CTL OFFSET: 0C1Ah RESET = 0000_0000h | | | PF23 Control Register Base Address: BF80_0000h |
|--------------------------------------------------------|----------|-----|----------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO87 001 - SPI_D1 |

TABLE 3-36: PROGRAMMABLE FUNCTION 24 CONTROL

| PF24_CTL OFFSET: 0C1Bh RESET = 0000_0000h | | | PF24 Control Register Base Address: BF80_0000h |
|--------------------------------------------------------|----------|-----|----------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO88 001 - SPI_D2 |

TABLE 3-37: PROGRAMMABLE FUNCTION 25 CONTROL

| PF25_CTL OFFSET: 0C1Ch RESET = 0000_0000h | | | PF25 Control Register Base Address: BF80_0000h |
|--------------------------------------------------------|----------|-----|----------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO89 001 - SPI_D3 |

TABLE 3-38: PROGRAMMABLE FUNCTION 26 CONTROL

| PF26_CTL OFFSET: 0C1Dh RESET = 0000_0000h | | | PF26 Control Register Base Address: BF80_0000h |
|--------------------------------------------------------|----------|-----|-----------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO90 001 - I2S_SCK 010 - UART_nDSR 011 - Reserved 100 - SLV_I2C_CLK |

TABLE 3-39: PROGRAMMABLE FUNCTION 27 CONTROL

| PF27_CTL OFFSET: 0C1Eh RESET = 0000_0000h | | | PF27 Control Register Base Address: BF80_0000h |
|--------------------------------------------------------|----------|-----|----------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO91 001 - I2S_MCLK 010 - UART_nDTR 011 - Reserved 100 - SLV_I2C_DATA 101 - PRT_CTL6/OCS 110 - UART_RX |

TABLE 3-40: PROGRAMMABLE FUNCTION 28 CONTROL

| PF28_CTL OFFSET: 0C1Fh RESET = 0000_0000h | | | PF28 Control Register Base Address: BF80_0000h |
|-------------------------------------------------|----------|-----|------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO92 001 - I2S_LRCK 010 - UART_nDSD 011 - PRT_CTL6/OCS 100 - UART_TX |

TABLE 3-41: PROGRAMMABLE FUNCTION 29 CONTROL

| PF29_CTL OFFSET: 0C20h RESET = 0000_0000h | | | PF29 Control Register Base Address: BF80_0000h |
|-------------------------------------------------|----------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO93 001 - CLOCK_OUT 010 - USB3_SUSP_IND 011 - USB2_SUSP_IND 100 - USB2_SUSP_IND or USB3_SUSP_IND (logical OR'ing of both USB2 and USB suspend indicators) |

TABLE 3-42: PROGRAMMABLE FUNCTION 30 CONTROL

| PF30_CTL OFFSET: 0C21h RESET = 0000_0000h | | | PF30 Control Register Base Address: BF80_0000h |
|-------------------------------------------------|----------|-----|-------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO94 001 - VBUS Routed to GPIO16 010 - MSTR_I2C_CLK |

TABLE 3-43: PROGRAMMABLE FUNCTION 31 CONTROL

| PF31_CTL OFFSET: 0C22h RESET = 0000_0000h | | | PF31 Control Register Base Address: BF80_0000h |
|-------------------------------------------------|----------|-----|------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read '0' |
| 3:0 | SELECT | R/W | 000 - GPIO95 001 - MSTR_I2C_DATA 010 - I2S_CLK |

TABLE 3-44: VENDOR ID LSB

| VID_LSB OFFSET: 3000h RESET = 24h | | | Vendor ID LSB Base Address: BF80_0000h |
|--------------------------------------------------------------|---------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | VID_LSB | R/W | Least Significant Byte of the Hub Vendor ID. This is a 16-bit value that uniquely identifies the vendor of the user device (assigned by USB-Implementers Forum). |

TABLE 3-45: VENDOR ID MSB

| VID_MSB OFFSET: 3001h RESET = 04h | | | Vendor ID MSB Base Address: BF80_0000h |
|--------------------------------------------------------------|---------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | VID_MSB | R/W | Most Significant Byte of the Hub Vendor ID. This is a 16-bit value that uniquely identifies the vendor of the user device (assigned by USB-Implementers Forum). |

TABLE 3-46: PRODUCT ID LSB

| PID_LSB OFFSET: 3002h RESET = XXh | | | Product ID LSB Base Address: BF80_0000h |
|--------------------------------------------------------------|---------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | PID_LSB | R/W | <p>Least Significant Byte of the Hub Product ID. This is a 16-bit value that the vendor can assign that uniquely identifies this product. The default value is dependent on the part as shown below:</p> <p>USB7002 = 02h USB7050 = 50h USB7051 = 51h USB7052 = 52h USB7056 = 56h</p> <p>Note that if port disable straps are implemented, these values will automatically decrement by the number of ports disabled by strapping. For example, if a design that implements USB4925 with two ports disabled by strapping, the Product ID (PID) will automatically change to 0x4923.</p> |

TABLE 3-47: PRODUCT ID MSB

| PID_MSB OFFSET: 3003h RESET = 70h | | | Product ID MSB Base Address: BF80_0000h |
|--------------------------------------------------------------|---------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | PID_MSB | R/W | <p>Most Significant Byte of the Hub Product ID. This is a 16-bit value that the vendor can assign that uniquely identifies this product. The default value is shown below:</p> <p>All part numbers = 70h</p> |

TABLE 3-48: DEVICE ID LSB

| DID_LSB OFFSET: 3004h RESET = XXh | | | Device ID LSB Base Address: BF80_0000h |
|--------------------------------------------------------------|---------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | DID_LSB | R/W | Least Significant Byte of the Hub Device ID. This is a 16-bit device release number in BCD format assigned by OEM. This value will vary by part number and firmware/configuration revision. |

TABLE 3-49: DEVICE ID MSB

| DID_MSB OFFSET: 3005h RESET = XXh | | | Device ID MSB Base Address: BF80_0000h |
|--------------------------------------------------------------|---------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | DID_MSB | R/W | Most Significant Byte of the Hub Device ID. This is a 16-bit device release number in BCD format assigned by OEM. This value will vary by part number and firmware/configuration revision. |

TABLE 3-50: HUB CONFIGURATION DATA BYTE 1

| HUB_CFG1 OFFSET: 3006h RESET = 00h(3006h) | | | Hub Configuration Data Byte 1 Base Address: BF80_0000h |
|----------------------------------------------------------------------|--------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | SELF_BUS_PWR | R/W | Self or Bus Power: Selects between Self- and Bus-Powered operation. The Hub is either Self-Powered (draws less than 2 mA of upstream bus power) or Bus-Powered (limited to 100 mA maximum of upstream power prior to being configured by the host controller). When configured as a Bus-Powered device, the Microchip Hub consumes less than 100 mA of current prior to being configured. After configuration, the Bus-Powered Microchip hub (along with all associated hub circuitry, any embedded devices if part of a compound device, and 100 mA per externally available downstream port) must consume no more than 500 mA of upstream VBUS current. The current consumption is system-dependent, and the OEM must ensure that the USB2.0 specifications are not violated. When configured as a Self-Powered device, less than 1 mA of upstream VBUS current is consumed and all ports are available, with each port being capable of sourcing 500 mA of current. 0 = Bus-Powered operation 1 = Self-Powered operation |
| 6 | VSM_DISABLE | R/W | 0 = VSM Messaging is supported. 1 = VSM Messaging is disabled. When VSM is disabled, all vendor-specific messaging to the hub endpoint will be ignored with no ill effect. |

TABLE 3-50: HUB CONFIGURATION DATA BYTE 1 (CONTINUED)

| HUB_CFG1 OFFSET: 3006h RESET = 00h(3006h) | | | Hub Configuration Data Byte 1 Base Address: BF80_0000h |
|-------------------------------------------------|-------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 5 | HS_DISABLE | R/W | <p>High Speed Disable: Disables the capability to attach as either a High- or Full-Speed device, and forces attachment as Full-Speed only (that is, no High-Speed support).</p> <p>0 = High-/Full-Speed 1 = Full-Speed-Only (High-Speed disabled!)</p> |
| 4 | MTT_ENABLE | R/W | <p>Multi-TT enable: Enables one transaction translator per port operation.</p> <p>Selects between a mode where only one transaction translator is available for all ports (Single-TT), or each port gets a dedicated transaction translator (Multi-TT).</p> <p>The host may force Single-TT mode only.</p> <p>0 = Single TT for all ports 1 = One TT per port (multiple TT's supported)</p> |
| 3 | EOP_DISABLE | R/W | <p>EOP Disable: Disables EOP generation of EOF1 when in Full-Speed mode. During FS operation only, this permits the hub to send EOP if no downstream traffic is detected at EOF1. See Section 11.3.1 of the USB 2.0 Specification for additional details. Note: Generation of an EOP at the EOF1 point may prevent a host controller (operating in FS mode) from placing the USB bus in suspend.</p> <p>0 = An EOP is generated at the EOF1 point if no traffic is detected. 1 = EOP generation at EOF1 is disabled. This is a normal USB operation.</p> |
| 2:1 | CURRENT_SNS | R/W | <p>Over Current Sense: Selects current sensing on a port-by-port basis, all ports ganged, or none (only for bus-powered hubs). The ability to support current sensing on a port or ganged basis is hardware implementation dependent.</p> <p>00 = Ganged sensing (all ports together). The OCS source select registers need to be updated to select the OCS ganged input. 01 = Individual port-by-port 1x = Over current sensing not supported (must only be used with Bus-Powered configurations)</p> |
| 0 | PORT_PWR | R/W | <p>Port Power Switching: Enables power switching on all ports simultaneously (ganged), or port power is individually switched on and off on a port-by-port basis (individual). The ability to support power enabling on a port or ganged basis is hardware implementation dependent.</p> <p>0 = Ganged switching (all ports together) 1 = Individual port-by-port switching</p> |

TABLE 3-51: HUB CONFIGURATION DATA BYTE 2

| HUB_CFG2 OFFSET: 3007h RESET = 00h | | | Hub Configuration Data Byte 2 Base Address: BF80_0000h |
|------------------------------------------|----------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | Reserved | R/W | Reserved |
| 5:4 | OC_TIMER | R/W | Over Current Timer: Over Current Timer delay. This measures the minimum pulse width for which a pulse is considered valid. 00 = 50 ns 01 = 100 ns 10 = 200 ns 11 = 400 ns |
| 3 | COMPOUND | R/W | Compound Device: Allows the OEM to indicate that the Hub is part of a compound (see the USB Specification for definition) device. The applicable ports must also be defined as having a "Non-Removable Device." When configured via strapping options, declaring a port as non-removable automatically causes the hub controller to report that it is part of a compound device. 0 = No. 1 = Yes, the Hub is part of a compound device. |
| 2:0 | Reserved | R/W | Always read '0' |

TABLE 3-52: HUB CONFIGURATION DATA BYTE 3

| HUB_CFG3 OFFSET: 3008h RESET = 00h | | | Hub Configuration Data Byte 3 Base Address: BF80_0000h |
|------------------------------------------|-----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R/W | Reserved |
| 3 | PRTMAP_EN | R/W | Port Re-Mapping enable: Selects the method used by the hub to assign port numbers and disable ports. '0' = Standard mode. Strap options or the following registers are used to define which ports are enabled, and the port mapped as Port 'n' on the hub is reported as Port 'n' to the host, unless one of the ports is disabled, then the higher numbered ports are remapped to report contiguous port numbers to the host. '1' = Port Re-Map mode. The mode enables remapping via the registers defined below. Disable the LPM to use this feature in USB2 Hub Control . |
| 2:1 | Reserved | R/W | Always read '0' |
| 0 | STRING_EN | R/W | Enables String Descriptor Support '0' = String Support Disabled '1' = String Support Enabled |

TABLE 3-53: HUB NON-REMOVABLE DEVICE

| HUB_NRD OFFSET: 3009h RESET = XXh | | | Hub Non-Removable Device Base Address: BF80_0000h |
|--------------------------------------------------------------|-------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | HUB_NON_Rem | R/W | <p>Non-Removable Device: Indicates which ports include non-removable devices. '0' = Port is removable. '1' = Port is non-removable.</p> <p>Informs the Host if one of the active ports has a permanent device that is non-detachable from the Hub. The device must provide its own descriptor data. Bit 7 = 1; Port 7 is non-removable. Bit 6 = 1; Port 6 is non-removable. Bit 5 = 1; Port 5 is non-removable. Bit 4 = 1; Port 4 is non-removable. Bit 3 = 1; Port 3 is non-removable. Bit 2 = 1; Port 2 is non-removable. Bit 1 = 1; Port 1 is non removable. Bit 0 = Reserved, always = '0'</p> <p>When using the CFG_NON_Rem strap, the port configuration is selected by the resistor used as follows:</p> <p>200K PD - All removable 200K PU - Port 1 non-removable 10K PD - Ports 1, 2 non-removable 10K PU - Ports 1, 2, 3 non-removable 10R PD - Ports 1, 2, 3, 4 non-removable 10R PU - Ports 1, 2, 3, 4, 5, 6 non-removable No resistor - Not allowed</p> <p>The default value of this register depends on the product number and GFG_NON_Rem strap setting.</p> |

TABLE 3-54: PORT DISABLE - SELF POWERED

| PORT_DIS_S OFFSET: 300Ah RESET = 00h | | | Port Disable for Self-Powered Operation Base Address: BF80_0000h |
|--------------------------------------------|---------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | PORT_DIS_SELF | R/W | <p>Port Disable Self-Powered: Disables 1 or more ports. '0' = Port is available. '1' = Port is disabled.</p> <p>During Self-Powered operation, when PRTMAP_EN = 0, this selects the ports that are permanently disabled, and are not available to be enabled or enumerated by a host controller. The ports can be disabled in any order; the internal logic automatically reports the correct number of enabled ports to the USB host, and reorders the active ports to ensure proper function.</p> <p>When using the internal default option, the PRT_DIS[1:0] pins disable the appropriate ports.</p> <p>Bit 7 = 1; Port 7 is disabled. Bit 6 = 1; Port 6 is disabled. Bit 5 = 1; Port 5 is disabled. Bit 4 = 1; Port 4 is disabled. Bit 3 = 1; Port 3 is disabled. Bit 2 = 1; Port 2 is disabled. Bit 1 = 1; Port 1 is disabled. Bit 0 = Reserved, always = '0'</p> |

TABLE 3-55: PORT DISABLE - BUS POWERED

| PORT_DIS_B OFFSET: 300Bh RESET = 00h | | | Port Disable for Bus-Powered Operation Base Address: BF80_0000h |
|--------------------------------------------|--------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | PORT_DIS_BUS | R/W | <p>Port Disable Bus-Powered: Disables 1 or more ports. '0' = Port is available. '1' = Port is disabled.</p> <p>During Bus-Powered operation, when PRTMAP_EN = 0, this selects the ports that are permanently disabled, and are not available to be enabled or enumerated by a host controller. The ports can be disabled in any order; the internal logic automatically reports the correct number of enabled ports to the USB host, and reorders the active ports to ensure proper function.</p> <p>When using the internal default option, the PRT_DIS[1:0] pins disable the appropriate ports.</p> <p>Bit 7 = 1; Port 7 is disabled. Bit 6 = 1; Port 6 is disabled. Bit 5 = 1; Port 5 is disabled. Bit 4 = 1; Port 4 is disabled. Bit 3 = 1; Port 3 is disabled. Bit 2 = 1; Port 2 is disabled. Bit 1 = 1; Port 1 is disabled. Bit 0 = Reserved, always = '0'</p> |

TABLE 3-56: HUB MAX POWER - SELF POWERED

| H_MAXP_S OFFSET: 300Ch RESET = 01h | | | Max Current for Self-Powered Operation Base Address: BF80_0000h |
|-------------------------------------------------|------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | MAX_PWR_SP | R/W | <p>Max Power Self-Powered: Value in 2-mA increments that the hub consumes from an upstream port (VBUS) when operating as a self-powered hub. This value includes the hub silicon along with the combined power consumption (from VBUS) of all associated circuitry on the board. This value also includes the power consumption of a permanently attached peripheral if the hub is configured as a compound device, and the embedded peripheral reports 0 mA in its descriptors.</p> <p>The USB2.0 Specification does not permit this value to exceed 100 mA.</p> |

TABLE 3-57: HUB MAX POWER - BUS POWERED

| H_MAXP_B OFFSET: 300Dh RESET = 50h | | | Max Current for Bus-Powered Operation Base Address: BF80_0000h |
|-------------------------------------------------|------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | MAX_PWR_BP | R/W | <p>Max Power Bus-Powered: Value in 2-mA increments that the hub consumes from an upstream port (VBUS) when operating as a bus-powered hub. This value includes the hub silicon along with the combined power consumption (from VBUS) of all associated circuitry on the board. This value also includes the power consumption of a permanently attached peripheral if the hub is configured as a compound device, and the embedded peripheral reports 0 mA in its descriptors.</p> |

TABLE 3-58: HUB FEATURE CONTROLLER MAX CURRENT - SELF POWERED

| HC_MAXP_S OFFSET: 300Eh RESET = 01h | | | Hub Feature Controller Max Current for Self-Powered Operation Base Address: BF80_0000h |
|--------------------------------------------------|-------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | HC_MAX_C_SP | R/W | <p>Hub Feature Controller Max Current Self-Powered: Value in 1-mA increments that the hub consumes from an upstream port (VBUS) when operating as a self-powered hub. This value includes the hub silicon along with the combined power consumption (from VBUS) of all associated circuitry on the board. This value does NOT include the power consumption of a permanently attached peripheral if the hub is configured as a compound device.</p> <p>The USB2.0 Specification does not permit this value to exceed 100 mA.</p> |

TABLE 3-59: HUB FEATURE CONTROLLER MAX CURRENT - BUS POWERED

| HC_MAXP_B OFFSET: 300Fh RESET = 50h | | | Hub Feature Controller Max Current for Bus-Powered Operation Base Address: BF80_0000h |
|--------------------------------------------------|-------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | HC_MAX_C_BP | R/W | Hub Feature Controller Max Current Bus-Powered: Value in 1-mA increments that the hub consumes from an upstream port (VBUS) when operating as a bus-powered hub. This value includes the hub silicon along with the combined power consumption (from VBUS) of all associated circuitry on the board. This value does NOT include the power consumption of a permanently attached peripheral if the hub is configured as a compound device. |

TABLE 3-60: POWER-ON TIME REGISTER

| PWR_ON_TIME OFFSET: 3010h RESET = FAh | | | Power-On Time Register Base Address: BF80_0000h |
|----------------------------------------------------|---------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | POWER_ON_TIME | R/W | Power On Time: The length of time that is takes (in 2-ms intervals) from the time the host initiated power-on sequence begins on a port until power is good on that port. The system software uses this value to determine how long to wait before accessing a powered-on port. |

TABLE 3-61: MANUFACTURER STRING INDEX REGISTER

| MFR_STR_INDEX OFFSET: 3013h RESET = 01h | | | Manufacturer String Index Register Base Address: BF80_0000h |
|------------------------------------------------------|---------------|-----|-----------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | MFR_STR_INDEX | R/W | Manufacturer String Index |

TABLE 3-62: PRODUCT STRING INDEX REGISTER

| PRD_STR_INDEX OFFSET: 3014h RESET = 02h | | | Product String Index Register Base Address: BF80_0000h |
|------------------------------------------------------|---------------|-----|------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | PRD_STR_INDEX | R/W | Product String Index |

TABLE 3-63: SERIAL STRING INDEX REGISTER

| SER_STR_INDEX OFFSET: 3015h RESET = 00h | | | Serial String Index Register Base Address: BF80_0000h |
|------------------------------------------------------|---------------|-----|-----------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | SER_STR_INDEX | R/W | Serial String Index |

TABLE 3-64: BATTERY CHARGING ENABLE STATUS REGISTER

| BC_EN Offset: 30D0h RESET = XXh | | | Battery Charging Enable Status Register Base Address: BF80_0000h |
|---------------------------------------|------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | Reserved | R | Always 0 |
| 6:1 | BC_EN_STAT | R | <p>'0' = Battery Charging is OFF '1' = Battery Charging is ON</p> <p>Bit 6: Port 6 Bit 5: Port 5 Bit 4: Port 4 Bit 3: Port 3 Bit 2: Port 2 Bit 1: Port 1</p> <p>The default state of the register depends on the CFG_BC_EN strap setting.</p> <p>When using the CFG_BC_EN strap, the port configuration is selected by the resistor used as follows:</p> <ul style="list-style-type: none"> 200K PD - Battery charging is disabled on all ports. 200K PU - Port 1 BC is enabled. 10K PD - Ports 1, and 2 BC are enabled. 10K PU - Ports 1, 2, and 3 BC are enabled. 10R PD - Ports 1, 2, 3, and 4 BC are enabled. 10R PU - Ports 1, 2, 3, 4, 5, and 6 BC are enabled. No resistor - Not allowed |
| 0 | Reserved | R | Always 0 |

TABLE 3-65: START OCS LOCKOUT TIMER REGISTER

| OCS_LOCKOUT OFFSET: 30E1h RESET = 0Ah | | | Start OCS Lockout Timer Register Base Address: BF80_0000h |
|---------------------------------------------|----------------|-----|---------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | START_OCS_LOCK | R/W | This timer blocks OCS events after the port power is enabled and is specified in 1-ms increments. |

TABLE 3-66: PORT POWER STATUS

| PORT_PWR_STAT OFFSET: 30E5h RESET = 00h | | | Port Power Status Base Address: BF80_0000h |
|-----------------------------------------------|--------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:5 | Reserved | R | Always 0 |
| 7:1 | BPRTPWR[4:1] | R | <p>'0' = State of Port Power Enable is OFF '1' = State of Port Power Enable is ON</p> <p>Bit 7: Port 7 Bit 6: Port 6 Bit 5: Port 5 Bit 4: Port 4 Bit 3: Port 3 Bit 2: Port 2 Bit 1: Port 1</p> |
| 0 | Reserved | R | Always 0 |

TABLE 3-67: USB2 TEST MODE REGISTER

| USB2_TEST_MODE OFFSET: 30E6h RESET = 00h | | | USB2 Test Mode Register Base Address: BF80_0000h |
|------------------------------------------------|---------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | Reserved | R | Always 0 |
| 6:1 | H_DN_STATE_PORT_TES | R | <p>'0' = Port is not in a USB2.0 Test mode.</p> <p>Bit 6 = 1; Port 6 is in a USB2.0 Test mode. Bit 5 = 1; Port 5 is in a USB2.0 Test mode. Bit 4 = 1; Port 4 is in a USB2.0 Test mode. Bit 3 = 1; Port 3 is in a USB2.0 Test mode. Bit 2 = 1; Port 2 is in a USB2.0 Test mode. Bit 1 = 1; Port 1 is in a USB2.0 Test mode.</p> |
| 0 | UP_STAT_TEST_MODE | R | <p>'0' = Upstream port is not in a USB2.0 Test mode. '1' = Upstream port is in a USB2.0 Test mode.</p> |

TABLE 3-68: LPM TURNAROUND TIMEOUT

| HS_TRESP_TIMEOUT OFFSET: 30E7h RESET = 00h | | | LPM Turnaround Timeout Register Base Address: BF80_0000h |
|--------------------------------------------------|-------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 6:0 | LPM_TIMEOUT | R/W | <p>This register sets the number of clocks the LPM logic will wait before timing out an LPM transaction on a downstream port.</p> <p>When this register is left at '0', a default value of 0x25 will be used. When this register holds a non-zero value, the register value is used.</p> |

TABLE 3-69: ENABLE OCS LEGACY REGISTER

| ENABLE_OCS_LEGACY OFFSET: 30E9h RESET = 00h | | | Enable OCS Legacy Base Address: BF80_0000h |
|----------------------------------------------------------|-------------------|-----|------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:3 | Reserved | R | Reserved; do not modify |
| 2 | ENABLE_OCS_LEGACY | R/W | |
| 1:0 | Reserved | R | Reserved; do not modify |

TABLE 3-70: OCS MINIMUM WIDTH REGISTER

| OCS_MIN_WIDTH OFFSET: 30EAh RESET = 05h | | | OCS Minimum Width Register Base Address: BF80_0000h |
|------------------------------------------------------|---------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | OCS_MIN_WIDTH | R/W | Contains the minimum OCS pulse width required to detect an OCS event. This field provides a range from 0 to 5 milliseconds in 1-ms increments. |

TABLE 3-71: OCS INACTIVE TIMER

| OCS_INACTIVE_TIMER OFFSET: 30EBh RESET = 14h | | | OCS Inactive Timer After First OCS Base Address: BF80_0000h |
|-----------------------------------------------------------|--------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | OCS_INACTIVE | R/W | Contains the maximum delay between two consecutive OCS pulses to occur to register as an OCS event. This field provides a range from 0 to 255 milliseconds in 1-ms increments. |

TABLE 3-72: HUB PORT SWAP REGISTER

| HUB_PRT_SWAP OFFSET: 30FAh RESET = 00h | | | Hub Port Swap Register Base Address: BF80_0000h |
|-----------------------------------------------------|----------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | PRT_SWAP | R/W | Port Swap: Swaps the upstream and downstream USB DP and DM pins for ease of board routing to devices and connectors. '0' = USB D+ functionality is associated with the DP pin, and D- functionality is associated with the DM pin. '1' = USB D+ functionality is associated with the DM pin, and D- functionality is associated with the DP pin. Bit 5 = '1': Port 5 DP/DM is Swapped. Bit 4 = '1': Port 4 DP/DM is Swapped. Bit 3 = '1': Port 3 DP/DM is Swapped. Bit 2 = '1': Port 2 DP/DM is Swapped. Bit 1 = '1': Port 1 DP/DM is Swapped. Bit 0 = '1': Upstream Port DP/DM is Swapped. |

TABLE 3-73: HUB PORT REMAP 1-2 REGISTER

| HUB_PRT_REMAP_12 OFFSET: 30FBh RESET = 00h | | | Hub Port 1-2 Remap Base Address: BF80_0000h |
|--------------------------------------------------|-----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | PRT_2_MAP | R/W | 0000b - Physical Port 2 is disabled. 0001b - Physical Port 2 is mapped to Logical Port 1. 0010b - Physical Port 2 is mapped to Logical Port 2. 0011b - Physical Port 2 is mapped to Logical Port 3. 0100b - Physical Port 2 is mapped to Logical Port 4. 0101b - Physical Port 2 is mapped to Logical Port 5. 0110b - Physical Port 2 is mapped to Logical Port 6. 0111b - Physical Port 2 is mapped to Logical Port 7. All other values default to 0000b value. |
| 3:0 | PRT_1_MAP | R/W | 0000b - Physical Port 1 is disabled. 0001b - Physical Port 1 is mapped to Logical Port 1. 0010b - Physical Port 1 is mapped to Logical Port 2. 0011b - Physical Port 1 is mapped to Logical Port 3. 0100b - Physical Port 1 is mapped to Logical Port 4. 0101b - Physical Port 1 is mapped to Logical Port 5. 0110b - Physical Port 1 is mapped to Logical Port 6. 0111b - Physical Port 1 is mapped to Logical Port 7. All other values default to 0000b value. |

Note: Writes to this register are disabled unless PRTMAP_EN bit in HUB_CFG_3 is set.

TABLE 3-74: HUB PORT REMAP 3-4 REGISTER

| HUB_PRT_REMAP_34 OFFSET: 30FCh RESET = 00h | | | Hub Port 3-4 Remap Base Address: BF80_0000h |
|--------------------------------------------------|-----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | PRT-4_MAP | R/W | 0000b - Physical Port 4 is disabled. 0001b - Physical Port 4 is mapped to Logical Port 1. 0010b - Physical Port 4 is mapped to Logical Port 2. 0011b - Physical Port 4 is mapped to Logical Port 3. 0100b - Physical Port 4 is mapped to Logical Port 4. 0101b - Physical Port 4 is mapped to Logical Port 5. 0110b - Physical Port 4 is mapped to Logical Port 6. 0111b - Physical Port 4 is mapped to Logical Port 7. All other values default to 0000b value. |
| 3:0 | PRT-3_MAP | R/W | 0000b - Physical Port 3 is disabled. 0001b - Physical Port 3 is mapped to Logical Port 1. 0010b - Physical Port 3 is mapped to Logical Port 2. 0011b - Physical Port 3 is mapped to Logical Port 3. 0100b - Physical Port 3 is mapped to Logical Port 4. 0101b - Physical Port 3 is mapped to Logical Port 5. 0110b - Physical Port 3 is mapped to Logical Port 6. 0111b - Physical Port 3 is mapped to Logical Port 7. All other values default to 0000b value. |

Note: Writes to this register are disabled unless PRTMAP_EN bit in HUB_CFG_3 is set.

TABLE 3-75: HUB PORT REMAP 5-6 REGISTER

| HUB_PRT_REMAP_56 OFFSET: 30FDh RESET = 00h | | | Hub Port 5-6 Remap Base Address: BF80_0000h |
|--------------------------------------------------|-----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | PRT-6_MAP | R/W | 0000b - Physical Port 6 is disabled. 0001b - Physical Port 6 is mapped to Logical Port 1. 0010b - Physical Port 6 is mapped to Logical Port 2. 0011b - Physical Port 6 is mapped to Logical Port 3. 0100b - Physical Port 6 is mapped to Logical Port 4. 0101b - Physical Port 6 is mapped to Logical Port 5. 0110b - Physical Port 6 is mapped to Logical Port 6. 0111b - Physical Port 6 is mapped to Logical Port 7. All other values default to 0000b value. |
| 3:0 | PRT-5_MAP | R/W | 0000b - Physical Port 5 is disabled. 0001b - Physical Port 5 is mapped to Logical Port 1. 0010b - Physical Port 5 is mapped to Logical Port 2. 0011b - Physical Port 5 is mapped to Logical Port 3. 0100b - Physical Port 5 is mapped to Logical Port 4. 0101b - Physical Port 5 is mapped to Logical Port 5. 0110b - Physical Port 5 is mapped to Logical Port 6. 0111b - Physical Port 5 is mapped to Logical Port 7. All other values default to 0000b value. |

Note: Writes to this register are disabled unless PRTMAP_EN bit in HUB_CFG_3 is set.

TABLE 3-76: HUB PORT REMAP 7 REGISTER

| HUB_PRT_REMAP_7 OFFSET: 30FEh RESET = 00h | | | Hub Port 7 Remap Base Address: BF80_0000h |
|-------------------------------------------------|-----------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R | Always read 0 |
| 3:0 | PRT-7_MAP | R/W | 0000b - Physical Port 7 is disabled 0001b - Physical Port 7 is mapped to Logical Port 1. 0010b - Physical Port 7 is mapped to Logical Port 2. 0011b - Physical Port 7 is mapped to Logical Port 3. 0100b - Physical Port 7 is mapped to Logical Port 4. 0101b - Physical Port 7 is mapped to Logical Port 5. 0110b - Physical Port 7 is mapped to Logical Port 6. 0111b - Physical Port 7 is mapped to Logical Port 7. All other values default to 0000b value. |

Note: Writes to this register are disabled unless PRTMAP_EN bit in HUB_CFG_3 is set.

TABLE 3-77: USB2 LINK STATE PORT 0-3

| USB2_LINK_STATE1 OFFSET: 3100h RESET = FFh | | | USB2 Link State1 Base Address: BF80_0000h |
|--------------------------------------------------|----------|-----|-----------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | L_STATE3 | R | Indicates the state of downstream Port 3 00b - L0 Normal Operation 01b - L1 Sleep 10b - L2 Suspend 11b - L3 Off |
| 5:4 | L_STATE2 | R | Indicates the state of downstream Port 2 00b - L0 Normal Operation 01b - L1 Sleep 10b - L2 Suspend 11b - L3 Off |
| 3:2 | L_STATE1 | R | Indicates the state of downstream Port 1 00b - L0 Normal Operation 01b - L1 Sleep 10b - L2 Suspend 11b - L3 Off |
| 1:0 | L_STATE0 | R | Indicates the state of Upstream Port 0 00b - L0 Normal Operation 01b - L1 Sleep 10b - L2 Suspend 11b - L3 Off |

TABLE 3-78: USB2 LINK STATE PORT 4-7

| USB2_LINK_STATE2 OFFSET: 3101h RESET = FFh | | | USB2 Link State2 Base Address: BF80_0000h |
|--------------------------------------------------|----------|-----|-----------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | L_STATE7 | R | Indicates the state of downstream Port 7 00b - L0 Normal Operation 01b - L1 Sleep 10b - L2 Suspend 11b - L3 Off |
| 5:4 | L_STATE6 | R | Indicates the state of downstream Port 6 00b - L0 Normal Operation 01b - L1 Sleep 10b - L2 Suspend 11b - L3 Off |
| 3:2 | L_STATE5 | R | Indicates the state of downstream Port 5 00b - L0 Normal Operation 01b - L1 Sleep 10b - L2 Suspend 11b - L3 Off |
| 1:0 | L_STATE4 | R | Indicates the state of downstream Port 4 00b - L0 Normal Operation 01b - L1 Sleep 10b - L2 Suspend 11b - L3 Off |

TABLE 3-79: USB2 HUB CONTROL

| USB2_HUB_CTL OFFSET: 3104h RESET = 00h | | | USB2 Hub Control Base Address: BF80_0000h |
|----------------------------------------------|-------------|-----|-------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:2 | RESERVED | R | Reserved |
| 1 | LPM_DISABLE | R/W | Disables Link Power Management |
| 0 | RESET | R/W | Hub reset downstream 0: Hub is in Normal mode. 1: Hub is kept in reset. |

TABLE 3-80: USB2 VERSION BCD[15:0]

| USB2_BCDUSB OFFSET: 3108h RESET = 0201h | | | USB2 Version BCD Base Address: BF80_0000h |
|-----------------------------------------------|--------------|-----|------------------------------------------------|
| Bit | Name | R/W | Description |
| 15:0 | USBVCD[15:0] | R/W | USB Specification Release Number in BCD format |

Note: 3108h-[15:8], 3109h-[7:0]

TABLE 3-81: HUB CONTROL PORTABLE TEST

| CNTLP OFFSET: 318Ch RESET = 00h | | | Hub Control Portable Test Base Address: BF80_0000h |
|---------------------------------------|-----------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | RESERVED | R | Reserved |
| 3:1 | EMBEDTEST | R/W | <p>Embedded Host Compliance Testing Modes. Enables test modes on USB ports. To facilitate embedded host compliance testing, the SOC may select any of the following test modes using the serial port interface instead of modifying the embedded host stack to accomplish the same modes using USB communication to the hub controller with standard SETUP packet commands. Both methods can be used for embedded host compliance testing with equivalent results. The Test modes described below are related to Section 7.1.20 of the USB 2.0 Specification and associated errata. Encoded values match the low nibble of the PID asserted by the HS-OPT when it requests the host to enter the associated Test mode. When the test mode is entered is continues until the embedTest control is written back to '000' by the SOC.</p> <p>0 (000) - Default Operation - No Test mode asserted 1 (001) - TEST_SE0_NAK - The hub enters high-speed receive and drives SE0 on the hub's downstream port, 2 (010) - TEST_J - The hub's downstream port enters high-speed J state. 3 (011) - TEST_K - The hub's downstream port enters high-speed K state. 4 (100) - TEST_PACKET - Sends test packets on downstream port.</p> <p>All others are reserved. The port in use is selected using the EMBED_TEST_PORT_SEL register.</p> |
| 0 | Reserved | R | Reserved |

TABLE 3-82: EMBEDDED HUB TEST PORT SELECT

| EMBED_TEST_PORT_SEL | | | Hub Test Port Select Base Address: BF80_0000h | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------|---------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---|------------------|---------|---|-------------------|---------|---|-------------------|---------|---|-------------------|---------|---|-------------------|---------|---|-------------------|---------|---|------------------------------|---------|---|---------------------|---------|---|--------------------|---------|---|--------------------|
| Bit | Name | R/W | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7:6 | Reserved | R | Reserved | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5:0 | PORT_SEL[4:0] | R/W | <p>Enables a port at the particular bit position. Any combination is permissible. Some examples are shown below:</p> <table> <tr><td>00_0000</td><td>-</td><td>Normal operation</td></tr> <tr><td>00_0001</td><td>-</td><td>Downstream Port 1</td></tr> <tr><td>00_0010</td><td>-</td><td>Downstream Port 2</td></tr> <tr><td>00_0100</td><td>-</td><td>Downstream Port 3</td></tr> <tr><td>00_1000</td><td>-</td><td>Downstream Port 4</td></tr> <tr><td>01_0000</td><td>-</td><td>Downstream Port 5</td></tr> <tr><td>00_0011</td><td>-</td><td>Downstream port 1 and port 2</td></tr> <tr><td>00_0111</td><td>-</td><td>Downstream port 1-3</td></tr> <tr><td>00_1111</td><td>-</td><td>Downstream port1-4</td></tr> <tr><td>11_1111</td><td>-</td><td>Downstream port1-6</td></tr> </table> <p>To enable testing of the upstream port, use FlexConnect to swap port 1 with the upstream port, and then run the EMBEDTEST on port 1.</p> | 00_0000 | - | Normal operation | 00_0001 | - | Downstream Port 1 | 00_0010 | - | Downstream Port 2 | 00_0100 | - | Downstream Port 3 | 00_1000 | - | Downstream Port 4 | 01_0000 | - | Downstream Port 5 | 00_0011 | - | Downstream port 1 and port 2 | 00_0111 | - | Downstream port 1-3 | 00_1111 | - | Downstream port1-4 | 11_1111 | - | Downstream port1-6 |
| 00_0000 | - | Normal operation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 00_0001 | - | Downstream Port 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 00_0010 | - | Downstream Port 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 00_0100 | - | Downstream Port 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 00_1000 | - | Downstream Port 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 01_0000 | - | Downstream Port 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 00_0011 | - | Downstream port 1 and port 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 00_0111 | - | Downstream port 1-3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 00_1111 | - | Downstream port1-4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11_1111 | - | Downstream port1-6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

TABLE 3-83: USB2 HUB STATUS REGISTER

| USB2_HUB_STAT | | | USB2 Hub Status Register Base Address: BF80_0000h |
|---------------|-------------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:1 | USB2_DN_CONNECTED | R | <p>USB Device connected on downstream port</p> <p>'1' = Device connected '0' = No device connected</p> <p>Bit 7 = Port 7 Bit 6 = Port 6 Bit 5 = Port 5 Bit 4 = Port 4 Bit 3 = Port 3 Bit 2 = Port 2 Bit 1 = Port 1</p> |
| 0 | USB2_HOST_DETECT | R | '1' = USB2 Host connected '0' = No USB2 host connected |

TABLE 3-84: USB2 DOWNSTREAM DEVICE SPEED[4-1]

| USB2_DN_SPEED41 OFFSET: 3195h RESET = 00h | | | USB2 Downstream Device Speed1 Base Address: BF80_0000h |
|-------------------------------------------------|--------------------|-----|-----------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | USB2_DN4_DEV_SPEED | R | Indicates the USB2.0 state of downstream Port 4 00b: No connect 01b: LS 10b: FS 11b: HS |
| 5:4 | USB2_DN3_DEV_SPEED | R | Indicates the USB2.0 state of downstream Port 3 00b: No connect 01b: LS 10b: FS 11b: HS |
| 3:2 | USB2_DN2_DEV_SPEED | R | Indicates the USB2.0 state of downstream Port 2 00b: No connect 01b: LS 10b: FS 11b: HS |
| 1:0 | USB2_DN1_DEV_SPEED | R | Indicates the USB2.0 state of downstream Port 1 00b: No connect 01b: LS 10b: FS 11b: HS |

TABLE 3-85: USB2 DOWNSTREAM DEVICE SPEED[7-5]

| USB2_DN_SPEED75 OFFSET: 3196h RESET = 00h | | | USB2 Downstream Device Speed2 Base Address: BF80_0000h |
|-------------------------------------------------|--------------------|-----|-----------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:2 | Reserved | R | Always reads 0 |
| 5:4 | USB2_DN7_DEV_SPEED | R | Indicates the USB2.0 state of downstream Port 7 00b: No connect 01b: LS 10b: FS 11b: HS |
| 3:2 | USB2_DN6_DEV_SPEED | R | Indicates the USB2.0 state of downstream Port 6 00b: No connect 01b: LS 10b: FS 11b: HS |
| 1:0 | USB2_DN5_DEV_SPEED | R | Indicates the USB2.0 state of downstream Port 5 00b: No connect 01b: LS 10b: FS 11b: HS |

TABLE 3-86: USB2 SUSPEND INDICATOR

| USB2_SUSP_IND OFFSET: 3197h RESET = 00h | | | USB2 Suspend Indicator Base Address: BF80_0000h |
|-----------------------------------------------|-------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:1 | Reserved | R | Always reads 0. Do not modify. |
| 0 | USB_SUSPEND | R | Suspend indicator 0 = Active; the hub is configured and operational. 1 = Inactive; the hub is not configured, or configured and is suspended in Sleep state. |

TABLE 3-87: PORT0 (UPSTREAM) PORT POWER SELECT

| PORT_CFG_SEL_0 OFFSET: 3C00h RESET = 80h | | | Port 0 Power Select Base Address: BF80_0000h |
|------------------------------------------------|----------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 31:23 | Reserved | R | Always reads 0. Do not modify. |
| 22 | ORIENTATION_POLARITY | R/W | This bit indicates/controls the Type-C orientation of the port. This register bit is controlled by the firmware and should not be modified externally under normal use-cases. |
| 21 | CC_ENABLE | R/W | This bit controls the Enable to CC Pin Detection logic. This should always be enabled for Type-C ports. This register bit is controlled by the firmware and should not be modified externally under normal use-cases. |
| 20:16 | Reserved | R | Always reads 0. Do not modify. |
| 15 | MUX_EN | R/W | Enables the internal MUX for Type-C routing of the USB3.1 signals. This register bit is controlled by the firmware and should not be modified externally under normal use-cases. 0 = Port MUX disabled 1 = Port MUX enabled |
| 14 | Reserved | R | Always reads 0. Do not modify. |
| 13:12 | C_MUX_SEL[1:0] | R/W | Control mode for the MUX for Type-C routing of the USB3.1 signals. This register bit is controlled by the firmware and should not be modified externally under normal use-cases. 00 = Firmware controls attach and orientation (this mode used for Power Delivery enabled ports). 01 = Firmware controls C_ATTACH, hardware logic controls ORIENTATION. (Used in custom application only) 10 = Firmware controls ORIENTATION, hardware logic controls C_ATTACH. (Used in custom application only) 11 = Hardware logic controls C_ATTACH and ORIENTATION. This mode is used for standard Type-C ports with no PD enabled.) |

TABLE 3-87: PORT0 (UPSTREAM) PORT POWER SELECT (CONTINUED)

| PORT_CFG_SEL_0 OFFSET: 3C00h RESET = 80h | | | Port 0 Power Select Base Address: BF80_0000h |
|------------------------------------------------|---------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 11 | C_SEL_BNA | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls which USB3.1 PHY is selected for the Type-C attach orientation. This bit is valid only if MUX_EN = 1 and PORT_TYPE = Type-C.</p> <p>0 = PHY side 'A' is selected. 1 = PHY side 'B' is selected.</p> |
| 10 | C_ATTACH | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls if a Type-C attach is detected.</p> <p>0 = No Type-C attach 1 = Type-C attach detected.</p> |
| 9:8 | PORT_TYPE | R/W | <p>Indicates the type of USB receptacle used on the port</p> <p>00 = Type-A with USB2 and USB3 01 = Type-C with USB2 and USB3 10 = Split. Type-A USB2 only, internal (embedded device) USB3 11 = Split. Type-C USB2 only, internal (embedded device) USB3</p> |
| 7 | COMBINED_MODE | R/W | <p>This should always be set to 1 for the standard use-case as both pins are always physically bonded out the same pin in the package.</p> <p>0 = The Port Power and Overcurrent Sense functions use separate physical pins. 1 = The Port Power and Overcurrent Sense functions use the same physical pin.</p> |
| 6 | GANG_PIN | R/W | When set, the port power will be connected to the GANG_PWR pin. |
| 5 | DISABLED | R/W | When set, disables the port. Used to inform the USB hub that a port is permanently disabled. |
| 4 | PERMANENT | R/W | When set, indicates that the port has a permanently attached device. |
| 3:0 | PRT_SEL | R/W | <p>This selects the source for PRT_CTL1.</p> <p>0000b = The port power is disabled. 0001b = The port is on if the USB2 port power is on (enable port power command received from USB2 host). 0010b = The port is on if the USB3 port power is on (enable port power command received from USB3 host). 0011b = The port is on if the USB2 or USB3 port power is on (enable port power command received from USB2 or USB3 host). 0100b = The port is on if the designated GPIO is on (change PRT_CTL pin to GPIO mode for external control via USB register write or SMBus/I²C register write).</p> <p>All other values are reserved.</p> |

TABLE 3-88: PORT1 PORT POWER SELECT

| PORT_CFG_SEL_1 OFFSET: 3C04h RESET = 80h | | | Port 1 Power Select Base Address: BF80_0000h |
|------------------------------------------------|-----------------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 31:23 | Reserved | R | Always reads 0. Do not modify. |
| 22 | ORIENTATION_POLARITY | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls the Type-C orientation of the port. |
| 21 | CC_ENABLE | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit controls the Enable to CC Pin Detection logic. This should always be enabled for Type-C ports. |
| 20 | AUTO_DETACH | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. When this bit is set, the MINIHOST_CONNECT bits will be set to 000b automatically when a device detach is detected. |
| 19:17 | MINIHOST_CONNECT[2:0] | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. 000 = Neutral condition (disconnected state) 001 = Port is connected to Mini-Host. 010 = Port is connected to the USB2 hub in USB1.1 mode. 011 = Port is connected in USB2 mode. 100 = Port is connected in USB3.1 Gen 1 mode. Others are reserved. |
| 16 | MINI_HOST_ENABLE | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. 0 = The port is a standard USB port connected to the USB hub. 1 = The port is under control by the Mini-Host. |
| 15 | MUX_EN | R/W | Enables the internal MUX for Type-C routing of the USB3.1 signals. This register bit is controlled by the firmware and should not be modified externally under normal use-cases. 0 = Port MUX disabled 1 = Port MUX enabled |
| 14 | Reserved | R | Always reads 0. Do not modify. |

TABLE 3-88: PORT1 PORT POWER SELECT (CONTINUED)

| PORT_CFG_SEL_1 OFFSET: 3C04h RESET = 80h | | | Port 1 Power Select Base Address: BF80_0000h |
|------------------------------------------------|----------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 13:12 | C_MUX_SEL[1:0] | R/W | <p>Control mode for the MUX for Type-C routing of the USB3.1 signals. This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>00 = Firmware controls attach and orientation (this mode used for Power Delivery enabled ports).</p> <p>01 = Firmware controls C_ATTACH, hardware logic controls ORIENTATION. (Used in custom application only)</p> <p>10 = Firmware controls ORIENTATION, hardware logic controls C_ATTACH. (Used in custom application only)</p> <p>11 = Hardware logic controls C_ATTACH and ORIENTATION. (This mode is used for standard Type-C ports with no PD enabled.)</p> |
| 11 | C_SEL_BNA | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls which USB3.1 PHY is selected for the Type-C attach orientation. This bit is valid only if MUX_EN = 1 and PORT_TYPE = Type-C.</p> <p>0 = PHY side 'A' is selected. 1 = PHY side 'B' is selected.</p> |
| 10 | C_ATTACH | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls if a Type-C attach is detected.</p> <p>0 = No Type-C attach 1 = Type-C attach detected</p> |
| 9:8 | PORT_TYPE | R/W | <p>Indicates the type of USB receptacle used on the port.</p> <p>00 = Type-A with USB2 and USB3 01 = Type-C with USB2 and USB3 10 = Split. Type-A USB2 only, internal (embedded device) USB3 11 = Split. Type-C USB2 only, internal (embedded device) USB3</p> |
| 7 | COMBINED_MODE | R/W | <p>This should always be set to 1 for the standard use-case as both pins are always physically bonded out the same pin in the package.</p> <p>0 = The Port Power and Overcurrent Sense functions use separate physical pins. 1 = The Port Power and Overcurrent Sense functions use the same physical pin.</p> |
| 6 | GANG_PIN | R/W | When set, the port power will be connected to the GANG_PWR pin. |
| 5 | DISABLED | R/W | When set, disables the port. Used to inform the USB hub that a port is permanently disabled. |
| 4 | PERMANENT | R/W | When set, indicates that the port has a permanently attached device. |

TABLE 3-88: PORT1 PORT POWER SELECT (CONTINUED)

| PORT_CFG_SEL_1 OFFSET: 3C04h RESET = 80h | | | Port 1 Power Select Base Address: BF80_0000h |
|------------------------------------------------|---------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 3:0 | PRT_SEL | R/W | <p>This selects the source for PRT_CTL1.</p> <p>0000b = The port power is disabled.</p> <p>0001b = The port is on if the USB2 port power is on (enable port power command received from USB2 host).</p> <p>0010b = The port is on if the USB3 port power is on (enable port power command received from USB3 host).</p> <p>0011b = The port is on if the USB2 or USB3 port power is on (enable port power command received from USB2 or USB3 host).</p> <p>0100b = The port is on if the designated GPIO is on (change PRT_CTL pin to GPIO mode for external control via USB register write or SMBus/I²C register write).</p> <p>All other values are reserved.</p> |

TABLE 3-89: PORT2 PORT POWER SELECT

| PORT_CFG_SEL_2 OFFSET: 3C08h RESET = 80h | | | Port 2 Power Select Base Address: BF80_0000h |
|------------------------------------------------|-----------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 31:23 | Reserved | R | Always reads 0. Do not modify. |
| 22 | ORIENTATION_POLARITY | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls the Type-C orientation of the port. |
| 21 | CC_ENABLE | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit controls the Enable to CC Pin Detection logic. This should always be enabled for Type-C ports. |
| 20 | AUTO_DETACH | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>When this bit is set, the MINIHOST_CONNECT bits will be set to 000b automatically when a device detach is detected.</p> |
| 19:17 | MINIHOST_CONNECT[2:0] | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>000 = Neutral condition (disconnected state)</p> <p>001 = The port is connected to Mini-Host.</p> <p>010 = The port is connected to the USB2 hub in USB1.1 mode.</p> <p>011 = The port is connected in USB2 mode.</p> <p>100 = The port is connected in USB3.1 Gen 1 mode.</p> <p>Others are reserved.</p> |
| 16 | MINI_HOST_ENABLE | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>0 = The port is a standard USB port connected to the USB hub.</p> <p>1 = The port is under control by the Mini-Host.</p> |

TABLE 3-89: PORT2 PORT POWER SELECT (CONTINUED)

| PORT_CFG_SEL_2 OFFSET: 3C08h RESET = 80h | | | Port 2 Power Select Base Address: BF80_0000h |
|------------------------------------------------|----------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 15 | MUX_EN | R/W | <p>Enables the internal MUX for Type-C routing of the USB3.1 signals. This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>0 = Port MUX disabled 1 = Port MUX enabled</p> |
| 14 | Reserved | R | Always reads 0. Do not modify. |
| 13:12 | C_MUX_SEL[1:0] | R/W | <p>Control mode for the MUX for Type-C routing of the USB3.1 signals. This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>00 = Firmware controls attach and orientation (this mode used for Power Delivery enabled ports).</p> <p>01 = Firmware controls C_ATTACH, hardware logic controls ORIENTATION. (Used in custom application only)</p> <p>10 = Firmware controls ORIENTATION, hardware logic controls C_ATTACH. (Used in custom application only)</p> <p>11 = Hardware logic controls C_ATTACH and ORIENTATION. (This mode used for standard Type-C ports with no PD enabled.)</p> |
| 11 | C_SEL_BNA | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls which USB3.1 PHY is selected for the Type-C attach orientation. This bit is valid only if MUX_EN = 1 and PORT_TYPE = Type-C.</p> <p>0 = PHY side 'A' is selected. 1 = PHY side 'B' is selected.</p> |
| 10 | C_ATTACH | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls if a Type-C attach is detected.</p> <p>0 = No Type-C attach 1 = Type-C attach detected</p> |
| 9:8 | PORT_TYPE | R/W | <p>Indicates the type of USB receptacle used on the port.</p> <p>00 = Type-A with USB2 and USB3 01 = Type-C with USB2 and USB3 10 = Split. Type-A USB2 only, internal (embedded device) USB3 11 = Split. Type-C USB2 only, internal (embedded device) USB3</p> |

TABLE 3-89: PORT2 PORT POWER SELECT (CONTINUED)

| PORT_CFG_SEL_2 OFFSET: 3C08h RESET = 80h | | | Port 2 Power Select Base Address: BF80_0000h |
|------------------------------------------------|---------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | COMBINED_MODE | R/W | <p>This should always be set to 1 for the standard use-case as both pins are always physically bonded out the same pin in the package.</p> <p>0 = The Port Power and Overcurrent Sense functions use separate physical pins. 1 = The Port Power and Overcurrent Sense functions use the same physical pin.</p> |
| 6 | GANG_PIN | R/W | When set, the port power will be connected to the GANG_PWR pin. |
| 5 | DISABLED | R/W | When set, disables the port. Used to inform the USB hub that a port is permanently disabled. |
| 4 | PERMANENT | R/W | When set, indicates that the port has a permanently attached device. |
| 3:0 | PRT_SEL | R/W | <p>This selects the source for PRT_CTL2.</p> <p>0000b = The port power is disabled. 0001b = The port is on if the USB2 port power is on (enable port power command received from USB2 host). 0010b = The port is on if the USB3 port power is on (enable port power command received from USB3 host). 0011b = The port is on if the USB2 or USB3 port power is on (enable port power command received from USB2 or USB3 host). 0100b = The port is on if the designated GPIO is on (change PRT_CTL pin to GPIO mode for external control via USB register write or SMBus/I²C register write).</p> <p>All other values are reserved.</p> |

TABLE 3-90: PORT3 PORT POWER SELECT

| PORT_CFG_SEL_3 OFFSET: 3C0Ch RESET = 80h | | | Port 3 Power Select Base Address: BF80_0000h |
|------------------------------------------------|----------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 31:23 | Reserved | R | Always reads 0. Do not modify. |
| 22 | ORIENTATION_POLARITY | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls the Type-C orientation of the port. |
| 21 | CC_ENABLE | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit controls the Enable to CC Pin Detection logic. This should always be enabled for Type-C ports. |
| 20 | AUTO_DETACH | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>When this bit is set, the MINIHOST_CONNECT bits will be set to 000b automatically when a device detach is detected.</p> |

TABLE 3-90: PORT3 PORT POWER SELECT (CONTINUED)

| PORT_CFG_SEL_3 OFFSET: 3C0Ch RESET = 80h | | | Port 3 Power Select Base Address: BF80_0000h |
|------------------------------------------------|-----------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 19:17 | MINIHOST_CONNECT[2:0] | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>000 = Neutral condition (disconnected state) 001 = The port is connected to Mini-Host. 010 = The port is connected to the USB2 hub in USB1.1 mode. 011 = The port is connected in USB2 mode. 100 = The port is connected in USB3.1 Gen 1 mode.</p> <p>Others are reserved.</p> |
| 16 | MINI_HOST_ENABLE | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>0 = The port is a standard USB port connected to the USB hub. 1 = The port is under control by the Mini-Host.</p> |
| 15 | MUX_EN | R/W | <p>Enables the internal MUX for Type-C routing of the USB3.1 signals. This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>0 = Port MUX disabled 1 = Port MUX enabled</p> |
| 14 | Reserved | R | Always reads 0. Do not modify. |
| 13:12 | C_MUX_SEL[1:0] | R/W | <p>Control mode for the MUX for Type-C routing of the USB3.1 signals. This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>00 = Firmware controls attach and orientation (this mode used for Power Delivery enabled ports). 01 = Firmware controls C_ATTACH, hardware logic controls ORIENTATION. (Used in custom application only) 10 = Firmware controls ORIENTATION, hardware logic controls C_ATTACH. (Used in custom application only) 11 = Hardware logic controls C_ATTACH and ORIENTATION. (This mode used for standard Type-C ports with no PD enabled.)</p> |
| 11 | C_SEL_BNA | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls which USB3.1 PHY is selected for the Type-C attach orientation. This bit is valid only if MUX_EN = 1 and PORT_TYPE = Type-C.</p> <p>0 = PHY side 'A' is selected. 1 = PHY side 'B' is selected.</p> |
| 10 | C_ATTACH | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls if a Type-C attach is detected.</p> <p>0 = No Type-C attach 1 = Type-C attach detected</p> |

TABLE 3-90: PORT3 PORT POWER SELECT (CONTINUED)

| PORT_CFG_SEL_3 OFFSET: 3C0Ch RESET = 80h | | | Port 3 Power Select Base Address: BF80_0000h |
|------------------------------------------------|---------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 9:8 | PORT_TYPE | R/W | <p>Indicates the type of USB receptacle used on the port</p> <p>00 = Type-A with USB2 and USB3 01 = Type-C with USB2 and USB3 10 = Split. Type-A USB2 only, internal (embedded device) USB3 11 = Split. Type-C USB2 only, internal (embedded device) USB3</p> |
| 7 | COMBINED_MODE | R/W | <p>This should always be set to 1 for the standard use-case as both pins are always physically bonded out the same pin in the package.</p> <p>0 = The Port Power and Overcurrent Sense functions use separate physical pins. 1 = The Port Power and Overcurrent Sense functions use the same physical pin.</p> |
| 6 | GANG_PIN | R/W | When set, the port power will be connected to the GANG_PWR pin. |
| 5 | DISABLED | R/W | When set, disables the port. Used to inform the USB hub that a port is permanently disabled. |
| 4 | PERMANENT | R/W | When set, indicates that the port has a permanently attached device. |
| 3:0 | PRT_SEL | R/W | <p>This selects the source for PRT_CTL3.</p> <p>0000b = The port power is disabled. 0001b = The port is on if the USB2 port power is on (enable port power command received from USB2 host). 0010b = The port is on if the USB3 port power is on (enable port power command received from USB3 host). 0011b = The port is on if the USB2 or USB3 port power is on (enable port power command received from USB2 or USB3 host). 0100b = The port is on if the designated GPIO is on (change PRT_CTL pin to GPIO mode for external control via USB register write or SMBus/I²C register write).</p> <p>All other values are reserved.</p> |

TABLE 3-91: PORT4 PORT POWER SELECT

| PORT_CFG_SEL_4 OFFSET: 3C10h RESET = 80h | | | Port 4 Power Select Base Address: BF80_0000h |
|------------------------------------------------|----------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 31:23 | Reserved | R | Always reads 0. Do not modify. |
| 22 | ORIENTATION_POLARITY | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls the Type-C orientation of the port. |
| 21 | CC_ENABLE | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit controls the Enable to CC Pin Detection logic. This should always be enabled for Type-C ports. |

TABLE 3-91: PORT4 PORT POWER SELECT (CONTINUED)

| PORT_CFG_SEL_4 OFFSET: 3C10h RESET = 80h | | | Port 4 Power Select Base Address: BF80_0000h |
|------------------------------------------------|-----------------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 20 | AUTO_DETACH | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>When this bit is set, the MINIHOST_CONNECT bits will be set to 000b automatically when a device detach is detected.</p> |
| 19:17 | MINIHOST_CONNECT[2:0] | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>000 = Neutral condition (disconnected state) 001 = The port is connected to Mini-Host. 010 = The port is connected to the USB2 hub in USB1.1 mode. 011 = The port is connected in USB2 mode. 100 = The port is connected in USB3.1 Gen 1 mode.</p> <p>Others are reserved.</p> |
| 16 | MINI_HOST_ENABLE | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>0 = The port is a standard USB port connected to the USB hub. 1 = The port is under control by the Mini-Host.</p> |
| 15 | MUX_EN | R/W | <p>Enables the internal MUX for Type-C routing of the USB3.1 signals. This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>0 = Port MUX disabled 1 = Port MUX enabled</p> |
| 14 | Reserved | R | Always reads 0. Do not modify. |
| 13:12 | C_MUX_SEL[1:0] | R/W | <p>Control mode for the MUX for Type-C routing of the USB3.1 signals. This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>00 = Firmware controls attach and orientation (this mode used for Power Delivery enabled ports). 01 = Firmware controls C_ATTACH, hardware logic controls ORIENTATION. (Used in custom application only) 10 = Firmware controls ORIENTATION, hardware logic controls C_ATTACH. (Used in custom application only) 11 = Hardware logic controls C_ATTACH and ORIENTATION. (This mode used for standard Type-C ports with no PD enabled.)</p> |
| 11 | C_SEL_BNA | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls which USB3.1 PHY is selected for the Type-C attach orientation. This bit is valid only if MUX_EN = 1 and PORT_TYPE = Type-C.</p> <p>0 = PHY side 'A' is selected. 1 = PHY side 'B' is selected.</p> |

TABLE 3-91: PORT4 PORT POWER SELECT (CONTINUED)

| PORT_CFG_SEL_4 OFFSET: 3C10h RESET = 80h | | | Port 4 Power Select Base Address: BF80_0000h |
|------------------------------------------------|---------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 10 | C_ATTACH | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls if a Type-C attach is detected.</p> <p>0 = No Type-C attach 1 = Type-C attach detected</p> |
| 9:8 | PORT_TYPE | R/W | <p>Indicates the type of USB receptacle used on the port.</p> <p>00 = Type-A with USB2 and USB3 01 = Type-C with USB2 and USB3 10 = Split. Type-A USB2 only, internal (embedded device) USB3 11 = Split. Type-C USB2 only, internal (embedded device) USB3</p> |
| 7 | COMBINED_MODE | R/W | <p>This should always be set to 1 for the standard use-case as both pins are always physically bonded out the same pin in the package.</p> <p>0 = The Port Power and Overcurrent Sense functions use separate physical pins. 1 = The Port Power and Overcurrent Sense functions use the same physical pin.</p> |
| 6 | GANG_PIN | R/W | When set, the port power will be connected to the GANG_PWR pin. |
| 5 | DISABLED | R/W | When set, disables the port. Used to inform the USB hub that a port is permanently disabled. |
| 4 | PERMANENT | R/W | When set, indicates that the port has a permanently attached device. |
| 3:0 | PRT_SEL | R/W | <p>This selects the source for PRT_CTL4.</p> <p>0000b = The port power is disabled. 0001b = The port is on if the USB2 port power is on (enable port power command received from USB2 host). 0010b = The port is on if the USB3 port power is on (enable port power command received from USB3 host). 0011b = The port is on if the USB2 or USB3 port power is on (enable port power command received from USB2 or USB3 host). 0100b = The port is on if the designated GPIO is on (change PRT_CTL pin to GPIO mode for external control via USB register write or SMBus/I²C register write).</p> <p>All other values are reserved.</p> |

TABLE 3-92: PORT5 PORT POWER SELECT

| PORT_CFG_SEL_5 OFFSET: 3C14h RESET = 80h | | | Port 5 Power Select Base Address: BF80_0000h |
|------------------------------------------------|-----------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 31:23 | Reserved | R | Always reads 0. Do not modify. |
| 22 | ORIENTATION_POLARITY | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls the Type-C orientation of the port. |
| 21 | CC_ENABLE | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit controls the Enable to CC Pin Detection logic. This should always be enabled for Type-C ports. |
| 20 | AUTO_DETACH | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. When this bit is set, the MINIHOST_CONNECT bits will be set to 000b automatically when a device detach is detected. |
| 19:17 | MINIHOST_CONNECT[2:0] | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. 000 = Neutral condition (disconnected state) 001 = The port is connected to Mini-Host. 010 = The port is connected to the USB2 hub in USB1.1 mode. 011 = The port is connected in USB2 mode. 100 = The port is connected in USB3.1 Gen 1 mode. Others are reserved. |
| 16 | MINI_HOST_ENABLE | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. 0 = The port is a standard USB port connected to the USB hub. 1 = The port is under control by the Mini-Host. |
| 15 | MUX_EN | R/W | Enables the internal MUX for Type-C routing of the USB3.1 signals. This register bit is controlled by the firmware and should not be modified externally under normal use-cases. 0 = Port MUX disabled 1 = Port MUX enabled |
| 14 | Reserved | R | Always reads 0. Do not modify. |

TABLE 3-92: PORT5 PORT POWER SELECT (CONTINUED)

| PORT_CFG_SEL_5 OFFSET: 3C14h RESET = 80h | | | Port 5 Power Select Base Address: BF80_0000h |
|------------------------------------------------|----------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 13:12 | C_MUX_SEL[1:0] | R/W | <p>Control mode for the MUX for Type-C routing of the USB3.1 signals. This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>00 = Firmware controls attach and orientation (this mode used for Power Delivery enabled ports).</p> <p>01 = Firmware controls C_ATTACH, hardware logic controls ORIENTATION. (Used in custom application only)</p> <p>10 = Firmware controls ORIENTATION, hardware logic controls C_ATTACH. (Used in custom application only)</p> <p>11 = Hardware logic controls C_ATTACH and ORIENTATION. (This mode used for standard Type-C ports with no PD enabled.)</p> |
| 11 | C_SEL_BNA | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls which USB3.1 PHY is selected for the Type-C attach orientation. This bit is valid only if MUX_EN = 1 and PORT_TYPE = Type-C</p> <p>0 = PHY side 'A' is selected. 1 = PHY side 'B' is selected.</p> |
| 10 | C_ATTACH | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls if a Type-C attach is detected.</p> <p>0 = No Type-C attach 1 = Type-C attach detected</p> |
| 9:8 | PORT_TYPE | R/W | <p>Indicates the type of USB receptacle used on the port.</p> <p>00 = Type-A with USB2 and USB3 01 = Type-C with USB2 and USB3 10 = Split. Type-A USB2 only, internal (embedded device) USB3 11 = Split. Type-C USB2 only, internal (embedded device) USB3</p> |
| 7 | COMBINED_MODE | R/W | <p>This should always be set to 1 for the standard use-case as both pins are always physically bonded out the same pin in the package.</p> <p>0 = The Port Power and Overcurrent Sense functions use separate physical pins. 1 = The Port Power and Overcurrent Sense functions use the same physical pin.</p> |
| 6 | GANG_PIN | R/W | When set, the port power will be connected to the GANG_PWR pin. |
| 5 | DISABLED | R/W | When set, disables the port. Used to inform the USB hub that a port is permanently disabled. |
| 4 | PERMANENT | R/W | When set, indicates that the port has a permanently attached device. |

TABLE 3-92: PORT5 PORT POWER SELECT (CONTINUED)

| PORT_CFG_SEL_5 OFFSET: 3C14h RESET = 80h | | | Port 5 Power Select Base Address: BF80_0000h |
|------------------------------------------------|---------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 3:0 | PRT_SEL | R/W | <p>This selects the source for PRT_CTL5.</p> <p>0000b = The port power is disabled.</p> <p>0001b = The port is on if the USB2 port power is on (enable port power command received from USB2 host).</p> <p>0010b = The port is on if the USB3 port power is on (enable port power command received from USB3 host).</p> <p>0011b = The port is on if the USB2 or USB3 port power is on (enable port power command received from USB2 or USB3 host).</p> <p>0100b = The port is on if the designated GPIO is on (change PRT_CTL pin to GPIO mode for external control via USB register write or SMBus/I²C register write).</p> <p>All other values are reserved.</p> |

TABLE 3-93: PORT6 PORT POWER SELECT

| PORT_CFG_SEL_6 OFFSET: 3C04h RESET = 80h | | | Port 6 Power Select Base Address: BF80_0000h |
|------------------------------------------------|-----------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 31:23 | Reserved | R | Always reads 0. Do not modify. |
| 22 | ORIENTATION_POLARITY | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls the Type-C orientation of the port. |
| 21 | CC_ENABLE | R/W | This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit controls the Enable to CC Pin Detection logic. This should always be enabled for Type-C ports. |
| 20 | AUTO_DETACH | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>When this bit is set, the MINIHOST_CONNECT bits will be set to 000b automatically when a device detach is detected.</p> |
| 19:17 | MINIHOST_CONNECT[2:0] | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>000 = Neutral condition (disconnected state)</p> <p>001 = The port is connected to Mini-Host.</p> <p>010 = The port is connected to the USB2 hub in USB1.1 mode.</p> <p>011 = The port is connected in USB2 mode.</p> <p>100 = The port is connected in USB3.1 Gen 1 mode.</p> <p>Others are reserved.</p> |
| 16 | MINI_HOST_ENABLE | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>0 = The port is a standard USB port connected to the USB hub.</p> <p>1 = The port is under control by the Mini-Host.</p> |

TABLE 3-93: PORT6 PORT POWER SELECT (CONTINUED)

| PORT_CFG_SEL_6 OFFSET: 3C04h RESET = 80h | | | Port 6 Power Select Base Address: BF80_0000h |
|------------------------------------------------|----------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 15 | MUX_EN | R/W | <p>Enables the internal MUX for Type-C routing of the USB3.1 signals. This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>0 = Port MUX disabled 1 = Port MUX enabled</p> |
| 14 | Reserved | R | Always reads 0. Do not modify. |
| 13:12 | C_MUX_SEL[1:0] | R/W | <p>Control mode for the MUX for Type-C routing of the USB3.1 signals. This register bit is controlled by the firmware and should not be modified externally under normal use-cases.</p> <p>00 = Firmware controls attach and orientation (this mode used for Power Delivery enabled ports).</p> <p>01 = Firmware controls C_ATTACH, hardware logic controls ORIENTATION. (Used in custom application only)</p> <p>10 = Firmware controls ORIENTATION, hardware logic controls C_ATTACH. (Used in custom application only)</p> <p>11 = Hardware logic controls C_ATTACH and ORIENTATION. (This mode used for standard Type-C ports with no PD enabled.)</p> |
| 11 | C_SEL_BNA | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls which USB3.1 PHY is selected for the Type-C attach orientation. This bit is valid only if MUX_EN = 1 and PORT_TYPE = Type-C.</p> <p>0 = PHY side 'A' is selected. 1 = PHY side 'B' is selected.</p> |
| 10 | C_ATTACH | R/W | <p>This register bit is controlled by the firmware and should not be modified externally under normal use-cases. This bit indicates/controls if a Type-C attach is detected.</p> <p>0 = No Type-C attach 1 = Type-C attach detected</p> |
| 9:8 | PORT_TYPE | R/W | <p>Indicates the type of USB receptacle used on the port.</p> <p>00 = Type-A with USB2 and USB3 01 = Type-C with USB2 and USB3 10 = Split. Type-A USB2 only, internal (embedded device) USB3 11 = Split. Type-C USB2 only, internal (embedded device) USB3</p> |

TABLE 3-93: PORT6 PORT POWER SELECT (CONTINUED)

| PORT_CFG_SEL_6 OFFSET: 3C04h RESET = 80h | | | Port 6 Power Select Base Address: BF80_0000h |
|------------------------------------------------|---------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | COMBINED_MODE | R/W | <p>This should always be set to 1 for the standard use-case as both pins are always physically bonded out the same pin in the package.</p> <p>0 = The Port Power and Overcurrent Sense functions use separate physical pins.</p> <p>1 = The Port Power and Overcurrent Sense functions use the same physical pin.</p> |
| 6 | GANG_PIN | R/W | When set, the port power will be connected to the GANG_PWR pin. |
| 5 | DISABLED | R/W | When set, disables the port. Used to inform the USB hub that a port is permanently disabled. |
| 4 | PERMANENT | R/W | When set, indicates that the port has a permanently attached device. |
| 3:0 | PRT_SEL | R/W | <p>This selects the source for PRT_CTL6.</p> <p>0000b = The port power is disabled.</p> <p>0001b = The port is on if the USB2 port power is on (enable port power command received from USB2 host).</p> <p>0010b = The port is on if the USB3 port power is on (enable port power command received from USB3 host).</p> <p>0011b = The port is on if the USB2 or USB3 port power is on (enable port power command received from USB2 or USB3 host).</p> <p>0100b = The port is on if the designated GPIO is on (change PRT_CTL pin to GPIO mode for external control via USB register write or SMBus/I²C register write).</p> <p>All other values are reserved.</p> |

TABLE 3-94: USB PORT1 OCS SOURCE SELECT

| USB_OCS_SEL_1 OFFSET: 3C20h RESET = 00h | | | Port 1 OCS Source Select Base Address: BF80_0000h |
|-----------------------------------------------|--------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | OCS_SEL_USB3 | R/W | <p>This selects the source for the OCS signal for port 1.</p> <p>0000b = OCS is disabled. 0001b = OCS comes from USB3 Hub OCS pin. 0010b = OCS pin comes from GPIO. 0011b = OCS pin comes from GANG_PWR pin. 1111b = OCS is forced on (for testing).</p> <p>All other values are reserved.</p> |
| 3:0 | OCS_SEL_USB2 | R/W | <p>This selects the source for the OCS signal for port 1.</p> <p>0000b = OCS is disabled. 0001b = OCS comes from USB2 Hub OCS logic. 0010b = OCS pin comes from GPIO. 0011b = OCS pin comes from GANG_PWR pin. 1111b = OCS is forced on (for testing).</p> <p>All other values are reserved.</p> |

TABLE 3-95: USB PORT2 OCS SOURCE SELECT

| USB_OCS_SEL_2 OFFSET: 3C24h RESET = 00h | | | Port 2 OCS Source Select Base Address: BF80_0000h |
|-----------------------------------------------|--------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | OCS_SEL_USB3 | R/W | <p>This selects the source for the OCS signal for port 2.</p> <p>0000b = OCS is disabled. 0001b = OCS comes from USB3 Hub OCS pin. 0010b = OCS pin comes from GPIO. 0011b = OCS pin comes from GANG_PWR pin. 1111b = OCS is forced on (for testing).</p> <p>All other values are reserved.</p> |
| 3:0 | OCS_SEL_USB2 | R/W | <p>This selects the source for the OCS signal for port 2.</p> <p>0000b = OCS is disabled. 0001b = OCS comes from USB2 Hub OCS logic. 0010b = OCS pin comes from GPIO. 0011b = OCS pin comes from GANG_PWR pin. 1111b = OCS is forced on (for testing).</p> <p>All other values are reserved.</p> |

TABLE 3-96: USB PORT 3 OCS SOURCE SELECT

| USB_OCS_SEL_3 OFFSET: 3C28h RESET = 00h | | | Port 3 OCS Source Select Base Address: BF80_0000h |
|-----------------------------------------------|----------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R/W | <p>This selects the source for the OCS signal for port 3.</p> <p>0000b = OCS is disabled. 0001b = OCS comes from USB3 Hub OCS pin. 0010b = OCS pin comes from GPIO. 0011b = OCS pin comes from GANG_PWR pin. 1111b = OCS is forced on (for testing).</p> <p>All other values are reserved.</p> |
| 3:0 | OCS_SEL | R/W | <p>This selects the source for the OCS signal for port 3.</p> <p>0 000b = OCS is disabled. 0001b = OCS comes from USB2 Hub OCS logic. 0010b = OCS pin comes from GPIO. 0011b = OCS pin comes from GANG_PWR pin. 1111b = OCS is forced on (for testing).</p> <p>All other values are reserved.</p> |

TABLE 3-97: USB PORT 4 OCS SOURCE SELECT

| USB_OCS_SEL_4 OFFSET: 3C2Ch RESET = 00h | | | Port 4 OCS Source Select Base Address: BF80_0000h |
|-----------------------------------------------|----------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R/W | <p>This selects the source for the OCS signal for port 4.</p> <p>0000b = OCS is disabled. 0001b = OCS comes from USB3 Hub OCS pin. 0010b = OCS pin comes from GPIO. 0011b = OCS pin comes from GANG_PWR pin. 1111b = OCS is forced on (for testing).</p> <p>All other values are reserved.</p> |
| 3:0 | OCS_SEL | R/W | <p>This selects the source for the OCS signal for port 4.</p> <p>0000b = OCS is disabled. 0001b = OCS comes from USB2 Hub OCS logic. 0010b = OCS pin comes from GPIO. 0011b = OCS pin comes from GANG_PWR pin. 1111b = OCS is forced on (for testing).</p> <p>All other values are reserved.</p> |

TABLE 3-98: USB PORT 5 OCS SOURCE SELECT

| USB_OCS_SEL_5 OFFSET: 3C30h RESET = 00h | | | Port 5 OCS Source Select Base Address: BF80_0000h |
|-----------------------------------------------|----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R/W | <p>This selects the source for the OCS signal for port 5.</p> <p>0000b = OCS is disabled. 0001b = OCS comes from USB3 Hub OCS pin. 0010b = OCS pin comes from GPIO. 0011b = OCS pin comes from GANG_PWR pin. 1111b = OCS is forced on (for testing).</p> <p>All other values are reserved.</p> |
| 3:0 | OCS_SEL | R/W | <p>This selects the source for the OCS signal for port 5.</p> <p>0000b = OCS is disabled. 0001b = OCS comes from USB2 Hub OCS logic. 0010b = OCS pin comes from GPIO. 0011b = OCS pin comes from GANG_PWR pin. 1111b = OCS is forced on (for testing).</p> <p>All other values are reserved.</p> |

TABLE 3-99: USB PORT 6 OCS SOURCE SELECT

| USB_OCS_SEL_6 OFFSET: 3034h RESET = 00h | | | Port 6 OCS Source Select Base Address: BF80_0000h |
|-----------------------------------------------|----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R/W | <p>This selects the source for the OCS signal for port 6.</p> <p>0000b = OCS is disabled. 0001b = OCS comes from USB3 Hub OCS pin. 0010b = OCS pin comes from GPIO. 0011b = OCS pin comes from GANG_PWR pin. 1111b = OCS is forced on (for testing).</p> <p>All other values are reserved.</p> |
| 3:0 | OCS_SEL | R/W | <p>This selects the source for the OCS signal for port 6.</p> <p>0000b = OCS is disabled. 0001b = OCS comes from USB2 Hub OCS logic. 0010b = OCS pin comes from GPIO. 0011b = OCS pin comes from GANG_PWR pin. 1111b = OCS is forced on (for testing).</p> <p>All other values are reserved.</p> |

TABLE 3-100: USB PORT 7 OCS SOURCE SELECT

| USB_OCS_SEL_7 OFFSET: 3038h RESET = 00h | | | Port 7 OCS Source Select Base Address: BF80_0000h |
|-----------------------------------------------|----------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R/W | <p>This selects the source for the OCS signal for port 7.</p> <p>0000b = OCS is disabled. 0001b = OCS comes from USB3 Hub OCS pin. 0010b = OCS pin comes from GPIO. 0011b = OCS pin comes from GANG_PWR pin. 1111b = OCS is forced on (for testing).</p> <p>All other values are reserved.</p> |
| 3:0 | OCS_SEL | R/W | <p>This selects the source for the OCS signal for port 7.</p> <p>0000b = OCS is disabled. 0001b = OCS comes from USB2 Hub OCS logic. 0010b = OCS pin comes from GPIO. 0011b = OCS pin comes from GANG_PWR pin. 1111b = OCS is forced on (for testing).</p> <p>All other values are reserved.</p> |

TABLE 3-101: VBUS_DET PASS THROUGH REGISTER

| VBUS_DET_PASS_THRU OFFSET: 3C40h RESET = 00h | | | VBUS_DET Pass-Through Register Base Address: BF80_0000h |
|----------------------------------------------------|----------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R/W | Always read 0 |
| 3:2 | USB3_PASS_THRU | R/W | <p>00 - The VBUS detection to the USB3 Hub comes from internal PIO24. 01 - The VBUS detection to the USB3 Hub comes from the VBUS_DET pin. 10 - The VBUS detection to the USB3 Hub comes from VBUS_MON pin. 11 - Reserved</p> |
| 1:0 | USB2_PASS_THRU | R/W | <p>00 - The VBUS detection to the USB2 Hub comes from internal PIO32. 01 - The VBUS detection to the USB2 Hub comes from the VBUS_DET pin. 10 - The VBUS detection to the USB2 Hub comes from VBUS_MON pin. 11 - Reserved</p> |

TABLE 3-102: PORT 0 (UPSTREAM) STATUS REGISTER

| PORT_STAT_REG_0 OFFSET: 3C50h RESET = 00h | | | Port 0 Status Register Base Address: BF80_0000h |
|--------------------------------------------------------|-----------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | Reserved | R/W | Always read 0 |
| 5 | A_ATTACH_STATUS | R | The current state of the Type-A port attach status. 1 = Type-A port currently has an attached device. 0 = Type-A port does not have an attached device. |
| 4 | C_ATTACH_STATUS | R | The current state of the Type-C port attach status. 1 = Type-C port currently has an attached device. 0 = Type-C port does not have an attached device. |
| 3 | USB_A_ATTACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 attach is detected. This is cleared by the firmware before enabling the port power for the port. |
| 2 | USB_C_ATTACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |
| 1 | USB_A_DETACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 detach is detected. Cleared by the hardware if the port power is not enabled for this port. |
| 0 | USB_C_DETACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |

TABLE 3-103: PORT 1 STATUS REGISTER

| PORT_STAT_REG_1 OFFSET: 3C54h RESET = 00h | | | Port 1 Status Register Base Address: BF80_0000h |
|--------------------------------------------------------|-----------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | Reserved | R/W | Always read 0 |
| 5 | A_ATTACH_STATUS | R | The current state of the Type-A port attach status. 1 = Type-A port currently has an attached device. 0 = Type-A port does not have an attached device. |
| 4 | C_ATTACH_STATUS | R | The current state of the Type-C port attach status. 1 = Type-C port currently has an attached device. 0 = Type-C port does not have an attached device. |
| 3 | USB_A_ATTACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 attach is detected. This is cleared by the firmware before enabling the port power for the port. |
| 2 | USB_C_ATTACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |
| 1 | USB_A_DETACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 detach is detected. Cleared by the hardware if the port power is not enabled for this port. |
| 0 | USB_C_DETACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |

TABLE 3-104: PORT 2 STATUS REGISTER

| PORT_STAT_REG_2 OFFSET: 3C58h RESET = 00h | | | Port 2 Status Register Base Address: BF80_0000h |
|-------------------------------------------------|-----------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R/W | Always read 0 |
| 5 | A_ATTACH_STATUS | R | The current state of the Type-A port attach status. 1 = Type-A port currently has an attached device. 0 = Type-A port does not have an attached device. |
| 4 | C_ATTACH_STATUS | R | The current state of the Type-C port attach status. 1 = Type-C port currently has an attached device. 0 = Type-C port does not have an attached device. |
| 3 | USB_A_ATTACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 attach is detected. This is cleared by the firmware before enabling the port power for the port. |
| 2 | USB_C_ATTACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |
| 1 | USB_A_DETACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 detach is detected. Cleared by the hardware if the port power is not enabled for this port. |
| 0 | USB_C_DETACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |

TABLE 3-105: PORT 3 STATUS REGISTER

| PORT_STAT_REG_3 OFFSET: 3C5Ch RESET = 00h | | | Port 3 Status Register Base Address: BF80_0000h |
|-------------------------------------------------|-----------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R/W | Always read 0 |
| 5 | A_ATTACH_STATUS | R | The current state of the Type-A port attach status. 1 = Type-A port currently has an attached device. 0 = Type-A port does not have an attached device. |
| 4 | C_ATTACH_STATUS | R | The current state of the Type-C port attach status. 1 = Type-C port currently has an attached device. 0 = Type-C port does not have an attached device. |
| 3 | USB_A_ATTACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 attach is detected. This is cleared by the firmware before enabling the port power for the port. |
| 2 | USB_C_ATTACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |
| 1 | USB_A_DETACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 detach is detected. Cleared by the hardware if the port power is not enabled for this port. |
| 0 | USB_C_DETACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |

TABLE 3-106: PORT 4 STATUS REGISTER

| PORT_STAT_REG_4 OFFSET: 3C60h RESET = 00h | | | Port 4 Status Register Base Address: BF80_0000h |
|-------------------------------------------------|-----------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R/W | Always read 0 |
| 5 | A_ATTACH_STATUS | R | The current state of the Type-A port attach status. 1 = Type-A port currently has an attached device. 0 = Type-A port does not have an attached device. |
| 4 | C_ATTACH_STATUS | R | The current state of the Type-C port attach status. 1 = Type-C port currently has an attached device. 0 = Type-C port does not have an attached device. |
| 3 | USB_A_ATTACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 attach is detected. This is cleared by the firmware before enabling the port power for the port. |
| 2 | USB_C_ATTACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |
| 1 | USB_A_DETACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 detach is detected. Cleared by the hardware if the port power is not enabled for this port. |
| 0 | USB_C_DETACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |

TABLE 3-107: PORT 5 STATUS REGISTER

| PORT_STAT_REG_5 OFFSET: 3C64h RESET = 00h | | | Port 5 Status Register Base Address: BF80_0000h |
|-------------------------------------------------|-----------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R/W | Always read 0 |
| 5 | A_ATTACH_STATUS | R | The current state of the Type-A port attach status. 1 = Type-A port currently has an attached device. 0 = Type-A port does not have an attached device. |
| 4 | C_ATTACH_STATUS | R | The current state of the Type-C port attach status. 1 = Type-C port currently has an attached device. 0 = Type-C port does not have an attached device. |
| 3 | USB_A_ATTACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 attach is detected. This is cleared by the firmware before enabling the port power for the port. |
| 2 | USB_C_ATTACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |
| 1 | USB_A_DETACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 detach is detected. Cleared by the hardware if the port power is not enabled for this port. |
| 0 | USB_C_DETACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |

TABLE 3-108: PORT 6 STATUS REGISTER

| PORT_STAT_REG_6 OFFSET: 3C68h RESET = 00h | | | Port 6 Status Register Base Address: BF80_0000h |
|-------------------------------------------------|-----------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R/W | Always read 0 |
| 5 | A_ATTACH_STATUS | R | The current state of the Type-A port attach status. 1 = Type-A port currently has an attached device. 0 = Type-A port does not have an attached device. |
| 4 | C_ATTACH_STATUS | R | The current state of the Type-C port attach status. 1 = Type-C port currently has an attached device. 0 = Type-C port does not have an attached device. |
| 3 | USB_A_ATTACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 attach is detected. This is cleared by the firmware before enabling the port power for the port. |
| 2 | USB_C_ATTACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |
| 1 | USB_A_DETACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 detach is detected. Cleared by the hardware if the port power is not enabled for this port. |
| 0 | USB_C_DETACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |

TABLE 3-109: PORT 7 STATUS REGISTER

| PORT_STAT_REG OFFSET: 3C6Ch RESET = 00h | | | Port 7 Status Register Base Address: BF80_0000h |
|-----------------------------------------------|-----------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:4 | Reserved | R/W | Always read 0 |
| 5 | A_ATTACH_STATUS | R | The current state of the Type-A port attach status. 1 = Type-A port currently has an attached device. 0 = Type-A port does not have an attached device. |
| 4 | C_ATTACH_STATUS | R | The current state of the Type-C port attach status. 1 = Type-C port currently has an attached device. 0 = Type-C port does not have an attached device. |
| 3 | USB_A_ATTACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 attach is detected. This is cleared by the firmware before enabling the port power for the port. |
| 2 | USB_C_ATTACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |
| 1 | USB_A_DETACH | R | Set = 1 by hardware when a USB2 LS, FS, HS or USB3 detach is detected. Cleared by the hardware if the port power is not enabled for this port. |
| 0 | USB_C_DETACH | R | Set = 1 by hardware when USB Type-C attach detected. Cleared by the hardware if the port power is not enabled for this port. |

3.3.1.1 Port Control Registers

These registers control the analog signaling of specific ports.

TABLE 3-110: USB PORT 0 BOOST REGISTER

| HS_P0_BOOST OFFSET: 60CAh RESET = 00h | | | USB Port 0 Boost Register Base Address: BF80_0000h |
|---------------------------------------------|----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:3 | Reserved | R/W | Reserved. Do not modify. |
| 2:0 | HS_BOOST | R/W | <p>HS Output Current.</p> <p>000b: Nominal 17.78 mA 001b: Decrease by 5% 010b: Increase by 10% 011b: Increase by 5% 100b: Increase by 20% 101b: Increase by 15% 110b: Increase by 30% 111b: Increase by 25%</p> <p>Note: If adjusting this register, it might be necessary to also adjust the USB2_HS_DISC_TUNE[1:0] register if High-Speed disconnect issues are encountered.</p> |

TABLE 3-111: USB PORT 0 VARISENSE REGISTER

| HS_P0_VSENSE OFFSET: 60CCh RESET = 00h | | | USB Port 0 Varisense Register Base Address: BF80_0000h |
|----------------------------------------------|------------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | USB2_HS_DISC_TUNE[1:0] | R/W | <p>HS Disconnect Threshold Tuning</p> <p>00b: Nominal (575 mV) threshold 01b: 625-mV threshold (+8.6%) 10b: 675-mV threshold (+17%) 11b: 700-mV threshold (+22%)</p> |
| 5:3 | Reserved | R | Reserved. Do not modify. |
| 2:0 | SQ_TUNE[2:0] | R/W | <p>Squelch Tune</p> <p>000b: Nominal 100-mV Trip Point 001b: Decrease by 12.5 mV 010b: Decrease by 25 mV 011b: Decrease by 37.5 mV 100b: Decrease by 50 mV 101b: Decrease by 62.5 mV 110b: Increase by 25 mV 111b: Increase by 12.5 mV</p> |

TABLE 3-112: USB PORT 1 BOOST REGISTER

| HS_P1_BOOST OFFSET: 64CAh RESET = 00h | | | USB Port 1 Boost Register Base Address: BF80_0000h |
|---------------------------------------------|----------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:3 | Reserved | R/W | Reserved. Do not modify. |
| 2:0 | HS_BOOST | R/W | <p>HS Output Current</p> <p>000b: Nominal 17.78 mA 001b: Decrease by 5% 010b: Increase by 10% 011b: Increase by 5% 100b: Increase by 20% 101b: Increase by 15% 110b: Increase by 30% 111b: Increase by 25%</p> <p>Note: If adjusting this register, it might be necessary to also adjust the USB2_HS_DISC_TUNE[1:0] register if High-Speed disconnect issues are encountered.</p> |

TABLE 3-113: USB PORT 1 VARISENSE REGISTER

| HS_P1_VSENSE OFFSET: 64CCh RESET = 00h | | | USB Port 1 Varisense Register Base Address: BF80_0000h |
|----------------------------------------------|------------------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | USB2_HS_DISC_TUNE[1:0] | R/W | <p>HS Disconnect Threshold Tuning</p> <p>00b: Nominal (575 mV) threshold 01b: 625-mV threshold (+8.6%) 10b: 675-mV threshold (+17%) 11b: 700-mV threshold (+22%)</p> |
| 5:3 | Reserved | R | Reserved. Do not modify. |
| 2:0 | SQ_TUNE[2:0] | R/W | <p>Squelch Tune</p> <p>000b: Nominal 100-mV Trip Point</p> <p>001b: Decrease by 12.5 mV 010b: Decrease by 25 mV 011b: Decrease by 37.5 mV 100b: Decrease by 50 mV 101b: Decrease by 62.5 mV 110b: Increase by 25 mV 111b: Increase by 12.5 mV</p> |

TABLE 3-114: USB PORT 2 BOOST REGISTER

| HS_P2_BOOST OFFSET: 68CAh RESET = 00h | | | USB Port 2 Boost Register Base Address: BF80_0000h |
|---------------------------------------------|----------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:3 | Reserved | R/W | Reserved. Do not modify. |
| 2:0 | HS_BOOST | R/W | <p>HS Output Current</p> <p>000b: Nominal 17.78 mA 001b: Decrease by 5% 010b: Increase by 10% 011b: Increase by 5% 100b: Increase by 20% 101b: Increase by 15% 110b: Increase by 30% 111b: Increase by 25%</p> <p>Note: If adjusting this register, it might be necessary to also adjust the USB2_HS_DISC_TUNE[1:0] register if High-Speed disconnect issues are encountered.</p> |

TABLE 3-115: USB PORT 2 VARISENSE REGISTER

| HS_P2_VSENSE OFFSET: 68CCh RESET = 00h | | | USB Port 2 Varisense Register Base Address: BF80_0000h |
|----------------------------------------------|------------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | USB2_HS_DISC_TUNE[1:0] | R/W | <p>HS Disconnect Threshold Tuning</p> <p>00b: Nominal (575 mV) threshold 01b: 625-mV threshold (+8.6%) 10b: 675-mV threshold (+17%) 11b: 700-mV threshold (+22%)</p> |
| 5:3 | Reserved | R | Reserved. Do not modify. |
| 2:0 | SQ_TUNE[2:0] | R/W | <p>Squelch Tune</p> <p>000b: Nominal 100-mV Trip Point 001b: Decrease by 12.5 mV 010b: Decrease by 25 mV 011b: Decrease by 37.5 mV 100b: Decrease by 50 mV 101b: Decrease by 62.5 mV 110b: Increase by 25 mV 111b: Increase by 12.5 mV</p> |

TABLE 3-116: USB PORT 3 BOOST REGISTER

| HS_P3_BOOST OFFSET: 6CCAh RESET = 00h | | | USB Port 3 Boost Register Base Address: BF80_0000h |
|---------------------------------------------|----------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:3 | Reserved | R/W | Reserved. Do not modify. |
| 2:0 | HS_BOOST | R/W | <p>HS Output Current.</p> <p>000b: Nominal 17.78 mA 001b: Decrease by 5% 010b: Increase by 10% 011b: Increase by 5% 100b: Increase by 20% 101b: Increase by 15% 110b: Increase by 30% 111b: Increase by 25%</p> <p>Note: If adjusting this register, it might be necessary to also adjust the USB2_HS_DISC_TUNE[1:0] register if High-Speed disconnect issues are encountered.</p> |

TABLE 3-117: USB PORT 3 VARISENSE REGISTER

| HS_P3_VSENSE OFFSET: 6CCCCh RESET = 00h | | | USB Port 3 Varisense Register Base Address: BF80_0000h |
|-----------------------------------------------|------------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | USB2_HS_DISC_TUNE[1:0] | R/W | <p>HS Disconnect Threshold Tuning</p> <p>00b: Nominal (575 mV) threshold 01b: 625-mV threshold (+8.6%) 10b: 675-mV threshold (+17%) 11b: 700-mV threshold (+22%)</p> |
| 5:3 | Reserved | R | Reserved. Do not modify. |
| 2:0 | SQ_TUNE[2:0] | R/W | <p>Squelch Tune</p> <p>000b: Nominal 100-mV Trip Point 001b: Decrease by 12.5 mV 010b: Decrease by 25 mV 011b: Decrease by 37.5 mV 100b: Decrease by 50 mV 101b: Decrease by 62.5 mV 110b: Increase by 25 mV 111b: Increase by 12.5 mV</p> |

TABLE 3-118: USB PORT 4 BOOST REGISTER

| HS_P4_BOOST OFFSET: 70CAh RESET = 00h | | | USB Port 4 Boost Register Base Address: BF80_0000h |
|---------------------------------------------|----------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:3 | Reserved | R/W | Reserved. Do not modify. |
| 2:0 | HS_BOOST | R/W | <p>HS Output Current</p> <p>000b: Nominal 17.78 mA 001b: Decrease by 5% 010b: Increase by 10% 011b: Increase by 5% 100b: Increase by 20% 101b: Increase by 15% 110b: Increase by 30% 111b: Increase by 25%</p> <p>Note: If adjusting this register, it might be necessary to also adjust the USB2_HS_DISC_TUNE[1:0] register if High-Speed disconnect issues are encountered.</p> |

TABLE 3-119: USB PORT 4 VARISENSE REGISTER

| HS_P4_VSENSE OFFSET: 70CCh RESET = 00h | | | USB Port 4 Varisense Register Base Address: BF80_0000h |
|----------------------------------------------|------------------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | USB2_HS_DISC_TUNE[1:0] | R/W | <p>HS Disconnect Threshold Tuning</p> <p>00b: Nominal (575 mV) threshold 01b: 625-mV threshold (+8.6%) 10b: 675-mV threshold (+17%) 11b: 700-mV threshold (+22%)</p> |
| 5:3 | Reserved | R | Reserved. Do not modify. |
| 2:0 | SQ_TUNE[2:0] | R/W | <p>Squelch Tune</p> <p>000: Nominal 100-mV Trip Point 001: Decrease by 12.5 mV 010: Decrease by 25 mV 011: Decrease by 37.5 mV 100: Decrease by 50 mV 101: Decrease by 62.5 mV 110: Increase by 25 mV 111: Increase by 12.5 mV</p> |

TABLE 3-120: USB PORT 5 BOOST REGISTER

| HS_P5_BOOST OFFSET: 74CAh RESET = 00h | | | USB Port 5 Boost Register Base Address: BF80_0000h |
|---------------------------------------------|----------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:3 | Reserved | R/W | Reserved. Do not modify. |
| 2:0 | HS_BOOST | R/W | <p>HS Output Current</p> <p>000b: Nominal 17.78 mA 001b: Decrease by 5% 010b: Increase by 10% 011b: Increase by 5% 100b: Increase by 20% 101b: Increase by 15% 110b: Increase by 30% 111b: Increase by 25%</p> <p>Note: If adjusting this register, it might be necessary to also adjust the USB2_HS_DISC_TUNE[1:0] register if High-Speed disconnect issues are encountered.</p> |

TABLE 3-121: USB PORT 5 VARISENSE REGISTER

| HS_P5_VSENSE OFFSET: 74CCh RESET = 00h | | | USB Port 5 Varisense Register Base Address: BF80_0000h |
|----------------------------------------------|------------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | USB2_HS_DISC_TUNE[1:0] | R/W | <p>HS Disconnect Threshold Tuning</p> <p>00b: Nominal (575 mV) threshold 01b: 625-mV threshold (+8.6%) 10b: 675-mV threshold (+17%) 11b: 700-mV threshold (+22%)</p> |
| 5:3 | Reserved | R | Reserved. Do not modify. |
| 2:0 | SQ_TUNE[2:0] | R/W | <p>Squelch Tune</p> <p>000b: Nominal 100-mV Trip Point 001b: Decrease by 12.5 mV 010b: Decrease by 25 mV 011b: Decrease by 37.5 mV 100b: Decrease by 50 mV 101b: Decrease by 62.5 mV 110b: Increase by 25 mV 111b: Increase by 12.5 mV</p> |

TABLE 3-122: HFC PRODUCT ID LSB

| HFC_PID_LSB OFFSET: 2856h RESET = 4Xh | | | HFC Product ID LSB Base Address: BFD2_0000h | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------------------|-------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------|---------------|-------|-----|-------|----------|-------|--------------------|-------|-------------|-------|-------------------|-------|-----------------------|-------|-------------|-------|------------------------|-------|----------------------------|-------|
| Bit | Name | R/W | Description | | | | | | | | | | | | | | | | | | | | | | |
| 7:0 | HFC_PID_LSB | R/W | <p>Least Significant Byte of the HFC Product ID. This is a 16-bit value that uniquely identifies this HFC device. The default value depends on the features enabled on the device as shown below:</p> <table> <tbody> <tr><td>I2S Audio only</td><td>= 42h</td></tr> <tr><td>I2S Audio/HID</td><td>= 43h</td></tr> <tr><td>CDC</td><td>= 44h</td></tr> <tr><td>I2S, CDC</td><td>= 46h</td></tr> <tr><td>I2S Audio/HID, CDC</td><td>= 47h</td></tr> <tr><td>WinUSB only</td><td>= 40h</td></tr> <tr><td>I2S Audio, WinUSB</td><td>= 4Ah</td></tr> <tr><td>I2S Audio/HID, WinUSB</td><td>= 4Bh</td></tr> <tr><td>WinUSB, CDC</td><td>= 4Ch</td></tr> <tr><td>I2S Audio, WinUSB, CDC</td><td>= 4Eh</td></tr> <tr><td>I2S Audio/HID, WinUSB, CDC</td><td>= 4Fh</td></tr> </tbody> </table> | I2S Audio only | = 42h | I2S Audio/HID | = 43h | CDC | = 44h | I2S, CDC | = 46h | I2S Audio/HID, CDC | = 47h | WinUSB only | = 40h | I2S Audio, WinUSB | = 4Ah | I2S Audio/HID, WinUSB | = 4Bh | WinUSB, CDC | = 4Ch | I2S Audio, WinUSB, CDC | = 4Eh | I2S Audio/HID, WinUSB, CDC | = 4Fh |
| I2S Audio only | = 42h | | | | | | | | | | | | | | | | | | | | | | | | |
| I2S Audio/HID | = 43h | | | | | | | | | | | | | | | | | | | | | | | | |
| CDC | = 44h | | | | | | | | | | | | | | | | | | | | | | | | |
| I2S, CDC | = 46h | | | | | | | | | | | | | | | | | | | | | | | | |
| I2S Audio/HID, CDC | = 47h | | | | | | | | | | | | | | | | | | | | | | | | |
| WinUSB only | = 40h | | | | | | | | | | | | | | | | | | | | | | | | |
| I2S Audio, WinUSB | = 4Ah | | | | | | | | | | | | | | | | | | | | | | | | |
| I2S Audio/HID, WinUSB | = 4Bh | | | | | | | | | | | | | | | | | | | | | | | | |
| WinUSB, CDC | = 4Ch | | | | | | | | | | | | | | | | | | | | | | | | |
| I2S Audio, WinUSB, CDC | = 4Eh | | | | | | | | | | | | | | | | | | | | | | | | |
| I2S Audio/HID, WinUSB, CDC | = 4Fh | | | | | | | | | | | | | | | | | | | | | | | | |

TABLE 3-123: HFC PRODUCT ID MSB

| HFC_PID_MSB OFFSET: 2857h RESET = 70h | | | HFC Product ID MSB Base Address: BFD2_0000h |
|---------------------------------------------|-------------|-----|---------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | HFC_PID_MSB | R/W | Most Significant Byte of the HFC Product ID. This is a 16-bit value that uniquely identifies this HFC device. |

TABLE 3-124: LANG_ID[15:0] LANGUAGE IDENTIFIER

| LANG_ID OFFSET: 3202h RESET = 0409h | | | USB-IF Language Identifier Base Address: BFD2_0000h |
|-------------------------------------------|---------|-----|-----------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 15:0 | LANG_ID | R/W | USB-IF Language Identifier. Default is English (United States). |

Note: 3202h-[7:0], 3203h-[15:8]

TABLE 3-125: MANUFACTURER STRING DESCRIPTOR

| MFG_STR OFFSET: 3204h RESET = 1Eh | | | Manufacturer String Base Address: BFD2_0000h |
|-----------------------------------------|-----------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Byte | Name | R/W | Description |
| 0 | Length | R/W | Descriptor size which is the Manufacturer String Size + 2. If this field is changed, the Manufacturer String Length register must also be updated with the same value. |
| 1 | Descriptor Type | R/W | 03h |
| 2 | String | R/W | Manufacturer String. This is the actual string in UNICODE UTF-16LE characters. Each character is stored with the LSB at the lower address, and the MSB at the next contiguous higher address. |

TABLE 3-126: PRODUCT STRING DESCRIPTOR

| PROD_STR OFFSET: 3244h RESET = 10h | | | Product String Base Address: BFD2_0000h |
|------------------------------------------|-----------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Byte | Name | R/W | Description |
| 0 | Length | R/W | Descriptor size which is the Product String Size + 2. If this field is changed, the Product String Length register must also be updated with the same value. |
| 1 | Descriptor Type | R/W | 03h |
| 2 | String | R/W | Product String. This is the actual string in UNICODE UTF-16LE characters. Each character is stored with the LSB at the lower address, and the MSB at the next contiguous higher address. |

TABLE 3-127: RUNTIME FLAGS MEMORY

| RUNTIME_FLAGS OFFSET: 3400h RESET = 0X00422228 | | | Runtime Flags Base Address: BFD2_0000h |
|------------------------------------------------------|--------------------------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 31:28 | RESERVED | R | Reserved, do not modify |
| 27 | GEN_EXCEPTION_RESET | R/W | 1 - If an exception occurs, reset the hub. 0 - If an exception occurs, code execution gets stuck in an infinite loop. |
| 26 | RESERVED | R | Reserved, do not modify |
| 25 | SS_MUX_FLIPPED | R/W | 1- Enable SS MUX flipped 0 - Disable SS MUX flipped ROM default value is 0. |
| 24 | RESERVED | R | Reserved, do not modify |
| 23 | DISABLE_CDP_MULTIPLE_HANDSHAKE | R/W | 1 - Except the primary handshake in CDP mode, subsequent handshake by the downstream device while in CDP mode will be ignored by the firmware. 0 - Multiple handshakes by the downstream device while in CDP mode will be acknowledged by the firmware until a time period of BC_CDP_MULTIPLE_HANDSHAKE_TIMEOUT expires after the first handshake in CDP mode. |
| 22 | ENABLE_QUADSPI | R/W | 0 - Quad SPI support is disabled in the firmware 1 - Quad SPI support is enabled in the firmware |
| 21 | DISABLE_I2CM_PULLUP_CHECK | R/W | 0 - Presence of I ² C pull-up resistors will be checked prior to I ² C bridging and in any other operation involving the hub as I ² C master. 1 - Presence of I ² C pull-up resistors will not be checked prior to I ² C bridging and in any other operation involving the hub as I ² C master. |
| 20 | DISABLE_USB3HUB | R/W | Flag to disable USB3 hub 0 - USB3 hub is enabled 1 - USB3 hub is disabled Default ROM value is 0. |

TABLE 3-127: RUNTIME FLAGS MEMORY (CONTINUED)

| RUNTIME_FLAGS OFFSET: 3400h RESET = 0X00422228 | | | Runtime Flags Base Address: BFD2_0000h |
|------------------------------------------------------|----------------------------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 19 | ENABLE_POWERSAVE | R/W | 1 - The clock control bits mentioned below will be turned off by the firmware, when not required. 0 - The clock control bits mentioned below will not be turned off by the firmware, once turned on. UDC1_CLK_EN_DUR_SUSPEND UDC2_CLK_EN_DUR_SUSPEND |
| 18:14 | RESERVED | R | Reserved |
| 13 | ENABLE_CDP_TO_SD_P_D_RECOVERY | R/W | 1 - Toggle downstream VBUS when a downstream device does not enumerate in CDP mode. 0 - Do not toggle downstream VBUS when a downstream device does not enumerate in CDP mode. Note that, by default in ROM, the flag is 1 to ensure that downstream device enumeration is prioritized. This bit needs to be cleared to zero to run battery charging compliance tests using PET tester. |
| 12 | OTP_LOCK | R/W | When set, this is a soft lock of the OTP. |
| 11 | DISABLE_CDC_REMOTEWAKEUP_FEATURE | R/W | 0 - CDC interface if enabled, reports as remote wakeup-capable. 1 - CDC interface is enabled, does not report as remote wakeup-capable. |
| 10 | DISABLE_125K_PU | R/W | 0 - 125K pull-up resistors are enabled in China-mode battery charging. 1 - 125K pull-up resistors are disabled in China-mode battery charging. |
| 9 | ENABLE_BC_UNIVERSAL | R/W | 0 - Disable BC 1.2-compliant changes to Universal BC algorithm 1 - Enable BC 1.2-compliant changes to Universal BC algorithm regardless of BC12_DCP bit in Runtime BC Flags (0x413X) If this is set to 1, then the HEARTBEAT_UNIT will be 5 ms. If this is set to 0, then the HEARTBEAT_UNIT will be 10 ms. |
| 8 | RESERVED | R | Reserved, do not modify |
| 7 | ENABLE_SPI_BYTE_FLASH | R/W | 0 - Generic SPI Flash commands issued for SPI Flash programming 1 - Microchip Byte Flash commands issued for SPI Flash programming |
| 6 | BYPASS MCU SUSPEND | R/W | 0 - Default UDC suspend handling 1 - MCU will not handle UDC suspend and will ignore the same. Note that if there is a suspend hook function present, that will be invoked still. |

TABLE 3-127: RUNTIME FLAGS MEMORY (CONTINUED)

| RUNTIME_FLAGS OFFSET: 3400h RESET = 0X00422228 | | | Runtime Flags Base Address: BFD2_0000h |
|------------------------------------------------------|-----------------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 5 | TARGET OTP | R/W | <p>Set target OTP</p> <p>0 - Any command targeted to OTP (OTP read, OTP programming, and so on) is redirected to the pseudo OTP in SPI Flash physical address 0x40000 to 0x41FFF.</p> <p>1 - Any command targeted to OTP (OTP read, OTP programming, and so on) is directed to the OTP.</p> |
| 4 | CFG_FROM_SPI | R/W | <p>Load config from SPI</p> <p>1 - Configuration is loaded from pseudo OTP in SPI.</p> <p>0 - Configuration will not be loaded from pseudo OTP in SPI.</p> |
| 3 | CFG_FROM OTP | R/W | <p>Load config from OTP</p> <p>1 - The firmware will load configuration from OTP.</p> <p>0 - Configuration will not be loaded from OTP.</p> |
| 2 | HUB_CFG_CLK | R/W | <p>Enable Hubcfg interface power-down</p> <p>1 - Clock-to-hub configuration registers are turned off after hub-attach to USB.</p> <p>0 - Clock-to-hub configuration registers are left on.</p> |
| 1 | UPDRESET THROUGH GPIO | R/W | Reserved, do not modify |
| 0 | DISABLE BC | R/W | <p>Disable battery charging</p> <p>1 - Battery charging logic is completely disabled.</p> <p>0 - Battery charging logic is left enabled based on other flags.</p> <p>ROM default is 0.</p> |

TABLE 3-128: RUNTIME FLAGS 2 MEMORY

| RUNTIME_FLAGS2 OFFSET: 3408h RESET = 0X00 | | | Runtime Flags 2 Base Address: BFD2_0000h |
|-------------------------------------------------|------------------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 31:14 | RESERVED | R | Reserved, do not modify |
| 13 | SPIPASSTHRU_RUN_FROM_ROM | R/W | <p>Flag to enable SPI pass-through function running from SPI or ROM</p> <p>0 - Running from SPI</p> <p>1 - Running from ROM</p> |
| 12 | PORTSPLIT_ENABLE_LTSSM_CHECK | R/W | <p>Flag to disable LTSSM state machine</p> <p>1 - LTSSM state check enabled</p> <p>0 - LTSSM state check disabled</p> <p>ROM default value is 1.</p> |

TABLE 3-128: RUNTIME FLAGS 2 MEMORY (CONTINUED)

| RUNTIME_FLAGS2 OFFSET: 3408h RESET = 0X00 | | | Runtime Flags 2 Base Address: BFD2_0000h |
|-------------------------------------------------|--------------------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 11 | I2CM_READ_MODE_INT | R/W | Flag to use Polling or Interrupt mode 1 - Interrupt mode 0 - Polling mode ROM default value is 1. |
| 10 | I2CM_WRITE_MODE_INT | R/W | Flag to use Polling or Interrupt mode 1 - Interrupt mode 0 - Polling mode ROM default value is 1. |
| 9 | RESERVED | R | Reserved, do not modify |
| 8 | DISABLE_UDC0_PORT | R/W | Flag to disable UDC0 port 0 - UDC0 port is enabled. 1 - UDC0 port is disabled. ROM default value is 0. |
| 7 | ENABLE_HIDBRIDGE | R/W | Flag to enable HID interface 0 - HID interface is disabled. 1 - HID interface is enabled. ROM default value is 0. |
| 6:5 | RESERVED | R | Reserved, do not modify |
| 4 | CDC_DISABLE | R/W | Flag to disable CDC interface when CDC configuration is selected through CFG_STRAP 0 - Not valid 1 - CDC interface is disabled in CDC mode ROM default value is 0. |
| 3 | I2S_DISABLE | R/W | Flag to disable I ² S interface when I ² S configuration is selected through CFG_STRAP 0 - Not valid 1 - I ² S interface is disabled in I ² S mode ROM default value is 0. |
| 2 | CONFIG_PORT_SPLIT | R/W | Flag to enable Port Split 0 - Port Split interface is disabled. 1 - Port Split interface is enabled. ROM default value is 0. |
| 1 | OTP_BASED_UDC_CONFIG | R/W | Flag to disable UDC configuration by ROM 0 - UDC port is configured by ROM. 1 - UDC port is configured by OTP/SMBus. ROM default value is 0. |
| 0 | OTP_BASED_WINUSB_DISABLE | R/W | Flag to disable WinUSB interface at UDC port. 0 - WinUSB interface enabled. 1 - WinUSB interface disabled. Default ROM value is 0. |

TABLE 3-129: I2S FEATURE SELECT REGISTER

| I2S_FEAT_SEL OFFSET: 3412h RESET = 03h | | | I²S Feature Unit Select Register Base Address: BFD2_0000h |
|-----------------------------------------------------|--------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:3 | Reserved | R | Reserved |
| 7:0 | I2S_UNIT_SEL | R/W | <p>Control features of the I²S interface if an I²S configuration is selected.</p> <p>00h: I²S is disabled. 001h: Audio IN through microphone is enabled. 02h: Audio OUT is enabled. 03h: Both Audio IN are enabled.</p> <p>All other values are reserved.</p> |

TABLE 3-130: I2S HID FEATURE SELECT REGISTER

| I2S_HFEAT_SEL OFFSET: 3413h RESET = 00h | | | I²S HID Feature Select Register Base Address: BFD2_0000h |
|------------------------------------------------------|-------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | I2S_HID_SEL | R/W | <p>Control features of the HID Control of the I²S interface if an I²S configuration is selected.</p> <p>00h: No I²S HID control 01h: Reserved 02h: HID interface controls speaker mute 03h: HID interface controls speaker mute and microphone mute</p> <p>All other values are reserved.</p> |

TABLE 3-131: SMBUS OTP RESULT

| SMBUS OTP RES OFFSET: 3419h RESET = 00h | | | SMBUS OTP Result Base Address: BFD2_0000h |
|------------------------------------------------------|----------|-----|-----------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:1 | RESERVED | R | Always reads 0 |
| 0 | RESULT | R | <p>Result of the last OTP command received through SMBus</p> <p>0: Command completed successfully 1: Command failed</p> |

TABLE 3-132: OTP UDC ENUMERATION

| OTP_UDC_ENABLE OFFSET: 341Bh RESET = 00h | | | OTP UDC Enumeration Base Address: BFD2_0000h |
|-------------------------------------------------------|------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | MODE | R/W | <p>Controls UDC Enumeration.</p> <p>00h: No change from default ROM behavior 01h: Enable UDC enumeration 02h: Disable UDC enumeration</p> <p>All other values are reserved.</p> |

TABLE 3-133: HUB PID MSB

| HUB_DEF_PIDM OFFSET: 341Eh RESET = 00h | | | Primary Hub Default PID MSB Base Address: BFD2_0000h |
|-----------------------------------------------------|-----------|-----|-------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | PRIH_PIDM | R/W | USB Primary Hub Default PID MSB. Reflects the SKU based on the bond and strap options, and could be different from the product PID. |

TABLE 3-134: HUB PID LSB

| HUB_DEF_PIDL OFFSET: 341Fh RESET = 00h | | | Primary Hub Default PID LSB Base Address: BFD2_0000h |
|-----------------------------------------------------|-----------|-----|-------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | PRIH_PIDL | R/W | USB Primary Hub Default PID LSB. Reflects the SKU based on the bond and strap options, and could be different from the product PID. |

TABLE 3-135: PORT1 BATTERY CHARGING CONFIGURATION

| BC_CONFIG_P1 OFFSET: 3433h RESET = 00h | | | Port 1 Battery Charging Configuration Base Address: BFD2_0000h |
|----------------------------------------------|-------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | UCS_LIM | R/W | When controlling UCS through I ² C, this sets the current limit. 00b: 500 mA 01b: 1000 mA 10b: 1500 mA 11b: 2000 mA |
| 5 | DCP | R/W | USB-IF Dedicated Charging Mode Enable, if bit 4 is set this bit is ignored. This mode is only activated when a USB host is not present. When a host is present the mode of operation is CDP. When SE1 mode and DCP mode are both enabled, the hub toggles between the two modes of operation as necessary to ensure the device can charge. 0: DCP disabled 1: DCP enabled |
| 4 | CHINA_MODE | R/W | China mode. Enables a 125k pull-up to D+/D- while shorting D+/D- together to allow certain Chinese market phones to charge. 0: China mode disabled 1: China mode enabled |
| 3 | Reserved | R/W | Reserved |
| 2:1 | SE1_EN[1:0] | R/W | Enables SE1 charging mode for certain devices. This mode is only activated when a USB host is not present. When a host is present, the mode of operation is CDP. When SE1 mode and DCP mode are both enabled, the hub toggles between the two modes of operation as necessary to ensure the device can charge. 00b: SE1 mode disabled 01b: SE1 1A mode enabled (D-: 2.7V, D+: 2.0V) 10b: SE1 2A mode enabled (D-: 2.0V, D+: 2.7V) 11b: SE1 2.5A mode enabled (D-: 2.7V, D+: 2.7V) |
| 0 | BC_EN | R/W | Battery Charging Support Enable. This bit enables CDP and must be set for any battery charging functions to be enabled. Other functions in addition to CDP are enabled by setting their respective bits in addition to this bit. 0: Battery charging support disabled 1: Battery charging support enabled |

TABLE 3-136: PORT2 BATTERY CHARGING CONFIGURATION

| BC_CONFIG_P2 OFFSET: 3434h RESET = 00h | | | Port 2 Battery Charging Configuration Base Address: BFD2_0000h |
|----------------------------------------------|-------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | UCS_LIM | R/W | <p>When controlling UCS through I²C, this sets the current limit.</p> <p>00b: 500 mA 01b: 1000 mA 10b: 1500 mA 11b: 2000 mA</p> |
| 5 | DCP | R/W | <p>USB-IF Dedicated Charging Mode Enable. This mode is only activated when a USB host is not present. When a host is present, the mode of operation is CDP. When SE1 mode and DCP mode are both enabled, the hub toggles between the two modes of operation as necessary to ensure the device can charge.</p> <p>0: DCP disabled 1: DCP enabled</p> |
| 4:3 | CHINA_MODE | R/W | <p>China mode. Enables a 125k pull-up to D+/D- while shorting D+/D-together to allow certain Chinese market phones to charge.</p> <p>0: China mode disabled 1: China mode enabled</p> |
| 2:1 | SE1_EN[1:0] | R/W | <p>Enables SE1 charging mode for certain devices. This mode is only activated when a USB host is not present. When a host is present, the mode of operation is CDP. When SE1 mode and DCP mode are both enabled, the hub toggles between the two modes of operation as necessary to ensure the device can charge.</p> <p>00b: SE1 mode disabled 01b: SE1 1A mode enabled (D-: 2.7V, D+: 2.0V) 10b: SE1 2A mode enabled (D-: 2.0V, D+: 2.7V) 11b: SE1 2.5A mode enabled (D-: 2.7V, D+: 2.7V)</p> |
| 0 | BC_EN | R/W | <p>Battery Charging Support Enable. This bit enables CDP and must be set for any battery charging functions to be enabled. Other functions in addition to CDP are enabled by setting their respective bits in addition to this bit.</p> <p>0: Battery charging support disabled 1: Battery charging support enabled</p> |

TABLE 3-137: PORT3 BATTERY CHARGING CONFIGURATION

| BC_CONFIG_P3 OFFSET: 3435h RESET = 00h | | | Port 3 Battery Charging Configuration Base Address: BFD2_0000h |
|----------------------------------------------|-------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | UCS_LIM | R/W | When controlling UCS through I ² C, this sets the current limit. 00b: 500 mA 01b: 1000 mA 10b: 1500 mA 11b: 2000 mA |
| 5 | DCP | R/W | USB-IF Dedicated Charging Mode Enable. This mode is only activated when a USB host is not present. When a host is present, the mode of operation is CDP. When SE1 mode and DCP mode are both enabled, the hub toggles between the two modes of operation as necessary to ensure the device can charge. 0: DCP disabled 1: DCP enabled |
| 4:3 | CHINA_MODE | R/W | China mode. Enables a 125k pull-up to D+/D- while shorting D+/D- together to allow certain Chinese market phones to charge. 0: China mode disabled 1: China mode enabled |
| 2:1 | SE1_EN[1:0] | R/W | Enables SE1 charging mode for certain devices. This mode is only activated when a USB host is not present. When a host is present, the mode of operation is CDP. When SE1 mode and DCP mode are both enabled, the hub toggles between the two modes of operation as necessary to ensure the device can charge. 00b: SE1 mode disabled 01b: SE1 1A mode enabled (D-: 2.7V, D+: 2.0V) 10b: SE1 2A mode enabled (D-: 2.0V, D+: 2.7V) 11b: SE1 2.5A mode enabled (D-: 2.7V, D+: 2.7V) |
| 0 | BC_EN | R/W | Battery Charging Support Enable. This bit enables CDP and must be set for any battery charging functions to be enabled. Other functions in addition to CDP are enabled by setting their respective bits in addition to this bit. 0: Battery charging support disabled 1: Battery charging support enabled |

TABLE 3-138: PORT4 BATTERY CHARGING CONFIGURATION

| BC_CONFIG_P4 OFFSET: 3436h RESET = 00h | | | Port 4 Battery Charging Configuration Base Address: BFD2_0000h |
|----------------------------------------------|-------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | UCS_LIM | R/W | <p>When controlling UCS through I²C, this sets the current limit.</p> <p>00b: 500 mA 01b: 1000 mA 10b: 1500 mA 11b: 2000 mA</p> |
| 5 | DCP | R/W | <p>USB-IF Dedicated Charging Mode Enable. This mode is only activated when a USB host is not present. When a host is present, the mode of operation is CDP. When SE1 mode and DCP mode are both enabled, the hub toggles between the two modes of operation as necessary to ensure the device can charge.</p> <p>0: DCP disabled 1: DCP enabled</p> |
| 4:3 | CHINA_MODE | R/W | <p>China mode. Enables a 125k pull-up to D+/D- while shorting D+/D-together to allow certain Chinese market phones to charge.</p> <p>0: China mode disabled 1: China mode enabled</p> |
| 2:1 | SE1_EN[1:0] | R/W | <p>Enables SE1 charging mode for certain devices. This mode is only activated when a USB host is not present. When a host is present, the mode of operation is CDP. When SE1 mode and DCP mode are both enabled, the hub toggles between the two modes of operation as necessary to ensure the device can charge.</p> <p>00b: SE1 mode disabled 01b: SE1 1A mode enabled (D-: 2.7V, D+: 2.0V) 10b: SE1 2A mode enabled (D-: 2.0V, D+: 2.7V) 11b: SE1 2.5A mode enabled (D-: 2.7V, D+: 2.7V)</p> |
| 0 | BC_EN | R/W | <p>Battery Charging Support Enable. This bit enables CDP and must be set for any battery charging functions to be enabled. Other functions in addition to CDP are enabled by setting their respective bits in addition to this bit.</p> <p>0: Battery charging support disabled 1: Battery charging support enabled</p> |

TABLE 3-139: PORT5 BATTERY CHARGING CONFIGURATION

| BC_CONFIG_P5 OFFSET: 3437h RESET = 00h | | | Port 5 Battery Charging Configuration Base Address: BFD2_0000h |
|----------------------------------------------|-------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | UCS_LIM | R/W | <p>When controlling UCS through I²C, this sets the current limit.</p> <p>00b: 500 mA 01b: 1000 mA 10b: 1500 mA 11b: 2000 mA</p> |
| 5 | DCP | R/W | <p>USB-IF Dedicated Charging Mode Enable. This mode is only activated when a USB host is not present. When a host is present, the mode of operation is CDP. When SE1 mode and DCP mode are both enabled, the hub toggles between the two modes of operation as necessary to ensure the device can charge.</p> <p>0: DCP disabled 1: DCP enabled</p> |
| 4:3 | CHINA_MODE | R/W | <p>China mode. Enables a 125k pull-up to D+/D- while shorting D+/D- together to allow certain Chinese market phones to charge.</p> <p>0: China mode disabled 1: China mode enabled</p> |
| 2:1 | SE1_EN[1:0] | R/W | <p>Enables SE1 charging mode for certain devices. This mode is only activated when a USB host is not present. When a host is present, the mode of operation is CDP. When SE1 mode and DCP mode are both enabled, the hub toggles between the two modes of operation as necessary to ensure the device can charge.</p> <p>00b: SE1 mode disabled 01b: SE1 1A mode enabled (D-: 2.7V, D+: 2.0V) 10b: SE1 2A mode enabled (D-: 2.0V, D+: 2.7V) 11b: SE1 2.5A mode enabled (D-: 2.7V, D+: 2.7V)</p> |
| 0 | BC_EN | R/W | <p>Battery Charging Support Enable. This bit enables CDP and must be set for any battery charging functions to be enabled. Other functions in addition to CDP are enabled by setting their respective bits in addition to this bit.</p> <p>0: Battery charging support disabled 1: Battery charging support enabled</p> |

TABLE 3-140: PORT6 BATTERY CHARGING CONFIGURATION

| BC_CONFIG_P6 OFFSET: 3438h RESET = 00h | | | Port 6 Battery Charging Configuration Base Address: BFD2_0000h |
|----------------------------------------------|-------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:6 | UCS_LIM | R/W | <p>When controlling UCS through I²C, this sets the current limit.</p> <p>00b: 500 mA 01b: 1000 mA 10b: 1500 mA 11b: 2000 mA</p> |
| 5 | DCP | R/W | <p>USB-IF Dedicated Charging Mode Enable. This mode is only activated when a USB host is not present. When a host is present, the mode of operation is CDP. When SE1 mode and DCP mode are both enabled, the hub toggles between the two modes of operation as necessary to ensure the device can charge.</p> <p>0: DCP disabled 1: DCP enabled</p> |
| 4:3 | CHINA_MODE | R/W | <p>China mode. Enables a 125k pull-up to D+/D- while shorting D+/D-together to allow certain Chinese market phones to charge.</p> <p>0: China mode disabled 1: China mode enabled</p> |
| 2:1 | SE1_EN[1:0] | R/W | <p>Enables SE1 charging mode for certain devices. This mode is only activated when a USB host is not present. When a host is present, the mode of operation is CDP. When SE1 mode and DCP mode are both enabled, the hub toggles between the two modes of operation as necessary to ensure the device can charge.</p> <p>00b: SE1 mode disabled 01b: SE1 1A mode enabled (D-: 2.7V, D+: 2.0V) 10b: SE1 2A mode enabled (D-: 2.0V, D+: 2.7V) 11b: SE1 2.5A mode enabled (D-: 2.7V, D+: 2.7V)</p> |
| 0 | BC_EN | R/W | <p>Battery Charging Support Enable. This bit enables CDP and must be set for any battery charging functions to be enabled. Other functions in addition to CDP are enabled by setting their respective bits in addition to this bit.</p> <p>0: Battery charging support disabled 1: Battery charging support enabled</p> |

TABLE 3-141: FLEX_IN_PORT1

| FLEX_IN_PORT1 OFFSET: 3442h RESET = 00h | | | FlexConnect Trigger Input Configuration Port 1 Base Address: BFD2_0000h |
|--------------------------------------------------------------------|-------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_IN_EN | R/W | <p>This bit is used to enable FlexConnect trigger for Port1 through the PIO input. The PIO is specified in the FLEX_IN_IO field.</p> <p>0b: FlexConnect trigger is disabled. 1b: FlexConnect trigger is enabled.</p> |
| 6:3 | RESERVED | R/W | Reserved |
| 2:0 | FLEX_IN_IO | R/W | <p>Selects the PIO used for FlexConnect trigger</p> <p>000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29</p> |

TABLE 3-142: FLEX_IN_PORT2

| FLEX_IN_PORT2 OFFSET: 3443h RESET = 00h | | | FlexConnect Trigger Input Configuration Port 2 Base Address: BFD2_0000h |
|--------------------------------------------------------------------|-------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_IN_EN | R/W | <p>This bit is used to enable FlexConnect trigger for Port2 through the PIO input. The PIO is specified in the FLEX_IN_IO field.</p> <p>0b: FlexConnect trigger is disabled. 1b: FlexConnect trigger is enabled.</p> |
| 6:3 | RESERVED | R/W | Reserved |
| 2:0 | FLEX_IN_IO | R/W | <p>Selects the PIO used for FlexConnect trigger</p> <p>000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29</p> |

TABLE 3-143: FLEX_IN_PORT3

| FLEX_IN_PORT3 OFFSET: 3444h RESET = 00h | | | FlexConnect Trigger Input Configuration Port 3 Base Address: BFD2_0000h |
|-----------------------------------------------|------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_IN_EN | R/W | <p>This bit is used to enable FlexConnect trigger for Port3 through the PIO input. The PIO is specified in the FLEX_IN_IO field.</p> <p>0b: FlexConnect trigger is disabled. 1b: FlexConnect trigger is enabled.</p> |
| 6:3 | RESERVED | R/W | Reserved |
| 2:0 | FLEX_IN_IO | R/W | <p>Selects the PIO used for FlexConnect trigger</p> <p>000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29</p> |

TABLE 3-144: FLEX_IN_PORT4

| FLEX_IN_PORT4 OFFSET: 3445h RESET = 00h | | | FlexConnect Trigger Input Configuration Port 4 Base Address: BFD2_0000h |
|-----------------------------------------------|------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_IN_EN | R/W | <p>This bit is used to enable FlexConnect trigger for Port4 through the PIO input. The PIO is specified in the FLEX_IN_IO field.</p> <p>0b: FlexConnect trigger is disabled. 1b: FlexConnect trigger is enabled.</p> |
| 6:3 | RESERVED | R/W | Reserved |
| 2:0 | FLEX_IN_IO | R/W | <p>Selects the PIO used for FlexConnect trigger</p> <p>000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29</p> |

TABLE 3-145: FLEX_IN_PORT5

| FLEX_IN_PORT5 OFFSET: 3446h RESET = 00h | | | FlexConnect Trigger Input Configuration Port 5 Base Address: BFD2_0000h |
|--------------------------------------------------------------------|-------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_IN_EN | R/W | <p>This bit is used to enable FlexConnect trigger for Port5 through the PIO input. The PIO is specified in the FLEX_IN_IO field.</p> <p>0b: FlexConnect trigger is disabled. 1b: FlexConnect trigger is enabled.</p> |
| 6:3 | RESERVED | R/W | Reserved |
| 2:0 | FLEX_IN_IO | R/W | <p>Selects the PIO used for FlexConnect trigger</p> <p>000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29</p> |

TABLE 3-146: FLEX_IN_PORT6

| FLEX_IN_PORT6 OFFSET: 3447h RESET = 00h | | | FlexConnect Trigger Input Configuration Port 6 Base Address: BFD2_0000h |
|--------------------------------------------------------------------|-------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_IN_EN | R/W | <p>This bit is used to enable FlexConnect trigger for Port6 through the PIO input. The PIO is specified in the FLEX_IN_IO field.</p> <p>0b: FlexConnect trigger is disabled. 1b: FlexConnect trigger is enabled.</p> |
| 6:3 | RESERVED | R/W | Reserved |
| 2:0 | FLEX_IN_IO | R/W | <p>Selects the PIO used for FlexConnect trigger</p> <p>000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29</p> |

TABLE 3-147: FLEX_OUT_PORT1

| FLEX_OUT_PORT1 OFFSET: 3448h RESET = 00h | | | FlexConnect State Indicator Configuration Port 1 Base Address: BFD2_0000h |
|---------------------------------------------|----------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_OUT_EN | R/W | This bit is used to enable the FlexConnect state indicator for Port1 through the PIO input. The PIO is specified in the FLEX_OUT_IO field. 0b: FlexConnect state indicator is disabled. 1b: FlexConnect state indicator is enabled. |
| 6 | FLEX_OUT_ACTIVE_HIGH | R/W | Selects PIO active state polarity 0b: PIO is driven active low in Flexstate. 1b: PIO is driven active high in Flexstate. |
| 5 | FLEX_OUT_OD | R/W | This bit is used to enable open drain output. 0b: PIO output is set as standard push-pull. 1b: PIO output is set as open drain. |
| 4:3 | RESERVED | R/W | Reserved |
| 2:0 | FLEX_OUT_IO | R/W | Selects the PIO used as the FlexConnect state indicator 000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29 |

TABLE 3-148: FLEX_OUT_PORT2

| FLEX_OUT_PORT2 OFFSET: 3449h RESET = 00h | | | FlexConnect State Indicator Configuration Port 2 Base Address: BFD2_0000h |
|---------------------------------------------|----------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_OUT_EN | R/W | This bit is used to enable the FlexConnect state indicator for Port2 through the PIO input. The PIO is specified in the FLEX_OUT_IO field. 0b: FlexConnect state indicator is disabled. 1b: FlexConnect state indicator is enabled. |
| 6 | FLEX_OUT_ACTIVE_HIGH | R/W | Selects PIO active state polarity 0b: PIO is driven active low in Flexstate. 1b: PIO is driven active high in Flexstate. |
| 5 | FLEX_OUT_OD | R/W | This bit is used to enable open drain output. 0b: PIO output is set as standard push-pull. 1b: PIO output is set as open drain. |
| 4:3 | RESERVED | R/W | Reserved |
| 2:0 | FLEX_OUT_IO | R/W | Selects the PIO used as the FlexConnect state indicator 000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29 |

TABLE 3-149: FLEX_OUT_PORT3

| FLEX_OUT_PORT3 OFFSET: 344Ah RESET = 00h | | | FlexConnect State Indicator Configuration Port 3 Base Address: BFD2_0000h |
|---------------------------------------------|----------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_OUT_EN | R/W | This bit is used to enable the FlexConnect state indicator for Port3 through the PIO input. The PIO is specified in the FLEX_OUT_IO field. 0b: FlexConnect state indicator is disabled. 1b: FlexConnect state indicator is enabled. |
| 6 | FLEX_OUT_ACTIVE_HIGH | R/W | Selects PIO active state polarity 0b: PIO is driven active low in Flexstate. 1b: PIO is driven active high in Flexstate. |
| 5 | FLEX_OUT_OD | R/W | This bit is used to enable open drain output. 0b: PIO output is set as standard push-pull. 1b: PIO output is set as open drain. |
| 4:3 | RESERVED | R/W | Reserved |
| 2:0 | FLEX_OUT_IO | R/W | Selects the PIO used as the FlexConnect state indicator 000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29 |

TABLE 3-150: FLEX_OUT_PORT4

| FLEX_OUT_PORT4 OFFSET: 344Bh RESET = 00h | | | FlexConnect State Indicator Configuration Port 4 Base Address: BFD2_0000h |
|---------------------------------------------|----------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_OUT_EN | R/W | This bit is used to enable the FlexConnect state indicator for Port4 through the PIO input. The PIO is specified in the FLEX_OUT_IO field. 0b: FlexConnect state indicator is disabled. 1b: FlexConnect state indicator is enabled. |
| 6 | FLEX_OUT_ACTIVE_HIGH | R/W | Selects PIO active state polarity 0b: PIO is driven active low in Flexstate. 1b: PIO is driven active high in Flexstate. |
| 5 | FLEX_OUT_OD | R/W | This bit is used to enable open drain output. 0b: PIO output is set as standard push-pull. 1b: PIO output is set as open drain. |
| 4:3 | RESERVED | R/W | Reserved |
| 2:0 | FLEX_OUT_IO | R/W | Selects the PIO used as the FlexConnect state indicator 000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29 |

TABLE 3-151: FLEX_OUT_PORT5

| FLEX_OUT_PORT5 OFFSET: 344Ch RESET = 00h | | | FlexConnect State Indicator Configuration Port 5 Base Address: BFD2_0000h |
|---------------------------------------------|----------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_OUT_EN | R/W | This bit is used to enable the FlexConnect state indicator for Port5 through the PIO input. The PIO is specified in the FLEX_OUT_IO field. 0b: FlexConnect state indicator is disabled. 1b: FlexConnect state indicator is enabled. |
| 6 | FLEX_OUT_ACTIVE_HIGH | R/W | Selects PIO active state polarity 0b: PIO is driven active low in Flexstate. 1b: PIO is driven active high in Flexstate. |
| 5 | FLEX_OUT_OD | R/W | This bit is used to enable open drain output. 0b: PIO output is set as standard push-pull. 1b: PIO output is set as open drain. |
| 4:3 | RESERVED | R/W | Reserved |
| 2:0 | FLEX_OUT_IO | R/W | Selects the PIO used as the FlexConnect state indicator 000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29 |

TABLE 3-152: FLEX_OUT_PORT6

| FLEX_OUT_PORT6 OFFSET: 344Dh RESET = 00h | | | FlexConnect State Indicator Configuration Port 6 Base Address: BFD2_0000h |
|---------------------------------------------|----------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_OUT_EN | R/W | This bit is used to enable the FlexConnect state indicator for Port6 through the PIO input. The PIO is specified in the FLEX_OUT_IO field. 0b: FlexConnect state indicator is disabled. 1b: FlexConnect state indicator is enabled. |
| 6 | FLEX_OUT_ACTIVE_HIGH | R/W | Selects PIO active state polarity 0b: PIO is driven active low in Flexstate. 1b: PIO is driven active high in Flexstate. |
| 5 | FLEX_OUT_OD | R/W | This bit is used to enable open drain output. 0b: PIO output is set as standard push-pull. 1b: PIO output is set as open drain. |
| 4:3 | RESERVED | R/W | Reserved |
| 2:0 | FLEX_OUT_IO | R/W | Selects the PIO used as the FlexConnect state indicator 000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29 |

TABLE 3-153: FLEX_PRTCTL_PORT1

| FLEX_PRTCTL_PORT1 OFFSET: 344Eh RESET = 00h | | | FlexConnect PRTCTL Configuration Port 1 Base Address: BFD2_0000h |
|----------------------------------------------------------|-----------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_PRTCTL_EN | R/W | This bit is used to enable Flex PRTCTL for PORT1. The PIO is specified in the FLEX_PRTCTL_IO field. 0b: Disables Flex PRTCTL1 output 1b: Enables Flex PRTCTL1 output |
| 6:5 | PRTCTL_OUT[1:0] | R/W | Selects the Flex PRTCTL1 output mode 00b: PRTCTL1 is tristated. 01b: PRTCTL1 is driven high. 10b: PRTCTL1 is driven low. 11b: PRTCTL1 is pulled up with internal pull-up. |
| 4 | RESERVED | R/W | Reserved |
| 3 | FLEX_PRTCTL_OEN | R/W | This bit is used to enable the Flex PRTCTL1 to output. 0b: Flex PRTCTL1 output is disabled. 1b: Flex PRTCTL1 output is enabled. |
| 2:0 | FLEX_PRTCTL_IO | R/W | Selects the PIO used as Flex PRTCTL1 000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29 |

TABLE 3-154: FLEX_PRTCTL_PORT2

| FLEX_PRTCTL_PORT2 OFFSET: 344Fh RESET = 00h | | | FlexConnect PRTCTL Configuration Port 2 Base Address: BFD2_0000h |
|---------------------------------------------------|-----------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_PRTCTL_EN | R/W | This bit is used to enable Flex PRTCTL for PORT2. The PIO is specified in the FLEX_PRTCTL_IO field. 0b: Disables Flex PRTCTL2 output 1b: Enables Flex PRTCTL2 output |
| 6:5 | PRTCTL_OUT[1:0] | R/W | Selects the Flex PRTCTL2 output mode 00b: PRTCTL2 is tristated. 01b: PRTCTL2 is driven high. 10b: PRTCTL2 is driven low. 11b: PRTCTL2 is pulled up with internal pull-up. |
| 4 | RESERVED | R/W | Reserved |
| 3 | FLEX_PRTCTL_OEN | R/W | This bit is used to enable the Flex PRTCTL2 to output. 0b: Flex PRTCTL2 output is disabled. 1b: Flex PRTCTL2 output is enabled. |
| 2:0 | FLEX_PRTCTL_IO | R/W | Selects the PIO used as Flex PRTCTL2 000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29 |

TABLE 3-155: FLEX_PRTCTL_PORT3

| FLEX_PRTCTL_PORT3 OFFSET: 3450h RESET = 00h | | | FlexConnect PRTCTL Configuration Port 3 Base Address: BFD2_0000h |
|---------------------------------------------------|-----------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_PRTCTL_EN | R/W | This bit is used to enable Flex PRTCTL for PORT3. The PIO is specified in the FLEX_PRTCTL_IO field. 0b: Disables Flex PRTCTL3 output 1b: Enables Flex PRTCTL3 output |
| 6:5 | PRTCTL_OUT[1:0] | R/W | Selects the Flex PRTCTL3 output mode 00b: PRTCTL3 is tristated. 01b: PRTCTL3 is driven high. 10b: PRTCTL3 is driven low. 11b: PRTCTL3 is pulled up with internal pull-up. |
| 4 | RESERVED | R/W | Reserved |
| 3 | FLEX_PRTCTL_OEN | R/W | This bit is used to enable the Flex PRTCTL3 to output. 0b: Flex PRTCTL3 output is disabled. 1b: Flex PRTCTL3 output is enabled. |
| 2:0 | FLEX_PRTCTL_IO | R/W | Selects the PIO used as Flex PRTCTL3 000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29 |

TABLE 3-156: FLEX_PRTCTL_PORT4

| FLEX_PRTCTL_PORT4 OFFSET: 3451h RESET = 00h | | | FlexConnect PRTCTL Configuration Port 4 Base Address: BFD2_0000h |
|---------------------------------------------------|-----------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_PRTCTL_EN | R/W | This bit is used to enable Flex PRTCTL for PORT4. The PIO is specified in the FLEX_PRTCTL_IO field. 0b: Disables Flex PRTCTL4 output 1b: Enables Flex PRTCTL4 output |
| 6:5 | PRTCTL_OUT[1:0] | R/W | Selects the Flex PRTCTL4 output mode 00b: PRTCTL4 is tristated. 01b: PRTCTL4 is driven high. 10b: PRTCTL4 is driven low. 11b: PRTCTL4 is pulled up with internal pull-up. |
| 4 | RESERVED | R/W | Reserved |
| 3 | FLEX_PRTCTL_OEN | R/W | This bit is used to enable the Flex PRTCTL4 to output. 0b: Flex PRTCTL4 output is disabled. 1b: Flex PRTCTL4 output is enabled. |
| 2:0 | FLEX_PRTCTL_IO | R/W | Selects the PIO used as Flex PRTCTL4 000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29 |

TABLE 3-157: FLEX_PRTCTL_PORT5

| FLEX_PRTCTL_PORT5 OFFSET: 3452h RESET = 00h | | | FlexConnect PRTCTL Configuration Port 5 Base Address: BFD2_0000h |
|----------------------------------------------------------|-----------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_PRTCTL_EN | R/W | This bit is used to enable Flex PRTCTL for PORT5. The PIO is specified in the FLEX_PRTCTL_IO field. 0b: Disables Flex PRTCTL5 output 1b: Enables Flex PRTCTL5 output |
| 6:5 | PRTCTL_OUT[1:0] | R/W | Selects the Flex PRTCTL5 output mode 00b: PRTCTL5 is tristated. 01b: PRTCTL5 is driven high. 10b: PRTCTL5 is driven low. 11b: PRTCTL5 is pulled up with internal pull-up. |
| 4 | RESERVED | R/W | Reserved |
| 3 | FLEX_PRTCTL_OEN | R/W | This bit is used to enable the Flex PRTCTL5 to output. 0b: Flex PRTCTL5 output is disabled. 1b: Flex PRTCTL5 output is enabled. |
| 2:0 | FLEX_PRTCTL_IO | R/W | Selects the PIO used as Flex PRTCTL5 000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29 |

TABLE 3-158: FLEX_PRTCTL_PORT6

| FLEX_PRTCTL_PORT6 OFFSET: 3453h RESET = 00h | | | FlexConnect PRTCTL Configuration Port 6 Base Address: BFD2_0000h |
|---------------------------------------------------|-----------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_PRTCTL_EN | R/W | This bit is used to enable Flex PRTCTL for PORT6. The PIO is specified in the FLEX_PRTCTL_IO field. 0b: Disables Flex PRTCTL6 output 1b: Enables Flex PRTCTL6 output |
| 6:5 | PRTCTL_OUT[1:0] | R/W | Selects the Flex PRTCTL6 output mode 00b: PRTCTL6 is tristated. 01b: PRTCTL6 is driven high. 10b: PRTCTL6 is driven low. 11b: PRTCTL6 is pulled up with internal pull-up. |
| 4 | RESERVED | R/W | Reserved |
| 3 | FLEX_PRTCTL_OEN | R/W | This bit is used to enable the Flex PRTCTL6 to output. 0b: Flex PRTCTL6 output is disabled. 1b: Flex PRTCTL6 output is enabled. |
| 2:0 | FLEX_PRTCTL_IO | R/W | Selects the PIO used as Flex PRTCTL6 000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29 |

TABLE 3-159: FLEX_VBUSDET

| FLEX_VBUSDET OFFSET: 3454h RESET = 00h | | | FlexConnect VBUSDET Configuration Base Address: BFD2_0000h |
|----------------------------------------------|-------------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7 | FLEX_VBUSDET_EN | R/W | This bit is used to select the source for VBUS_DET while in Flex state. 0b: VBUS_DET Hub pin is the VBUS_DET in Flex state. 1b: PFx pin selected in FLEX_VBUSDET_IO is the VBUS_DET in Flex state. |
| 6 | FLEX_VBUSDET_HIGH | R/W | 0b: VBUS_DET is driven as selected by FLEX_VBUSDET_EN. 1b: VBUS_DET is driven high internally. |
| 5:3 | RESERVED | R/W | Reserved |
| 2:0 | FLEX_VBUSDET_IO | R/W | Selects the PFx used as Flex VBUSDET 000b: PF6 001b: PF7 010b: PF14 011b: PF19 100b: PF26 101b: PF27 110b: PF28 111b: PF29 |

TABLE 3-160: FLEXCONNECT HUB ATTACH DELAY

| FLEX_ATTACH_DELAY OFFSET: 3455h RESET = 00h | | | FlexConnect Hub Attach Delay Base Address: BFD2_0000h |
|----------------------------------------------------------|-------------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | FLEX_ATTACH_DELAY | R/W | This field specifies the delay in 10-millisecond increments after Flex-Connect is initiated before the Hub is attached. This might be required to provide a debounce time between a USB device detach and a subsequent attach. |

TABLE 3-161: ROLE SWITCH DELAY

| ROLE_SWITCH_DELAY OFFSET: 3450h RESET = 00h | | | Role Switch Delay Base Address: BFD2_0000h |
|----------------------------------------------------------|-------------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | ROLE_SWITCH_DELAY | R/W | This field specifies the delay in 10-millisecond increments after the SET_ROLE_SWITCH command is initiated before the role switch is done. This might be required to provide a debounce time between a USB device detach and a subsequent attach. |

TABLE 3-162: MANUFACTURER STRING LENGTH

| MFG_STR_LEN OFFSET: 346Ah RESET = 1Eh | | | Manufacturer String Length Base Address: BFD2_0000h |
|----------------------------------------------------|--------|-----|----------------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | Length | R/W | Manufacturer String Descriptor size; this must be same as the value in the Length field of the Manufacturer String Descriptor . |

TABLE 3-163: PRODUCT STRING LENGTH

| PROD_STR_LEN OFFSET: 3472h RESET = 10h | | | Product String Length Base Address: BFD2_0000h |
|-----------------------------------------------------|--------|-----|------------------------------------------------------------------------------------------------------------------------------|
| Bit | Name | R/W | Description |
| 7:0 | Length | R/W | Product String Descriptor size; this must be same as the value in the Length field of the Product String Descriptor . |

4.0 SMBUS CONFIGURATION

The SMBus configuration begins in the **SOC Configuration Stage**. In this stage, the SOC may modify any of the configuration settings to customize the hub to their purposes. The SOC can configure the hub as Full Speed only, or can have the hub report a port as non-removable. The SOC can also disable a port entirely to conserve power. The hub can be addressed at the address **2Dh** and interprets the data bytes as shown in the following sub-sections.

4.1 SMBus Block Write

The SMBus block write consists of an Address+Direction(0) byte followed by the 16-bit memory address, split into two bytes. The address is used for special commands and as a pointer to the hub's internal memory. Following the address, the next byte of data corresponds to the count of data bytes that follows, which is up to 128 bytes in a block. Finally, a 00h write is used to terminate the write operation, followed by the SMBus stop signal.

TABLE 4-1: SMBUS BLOCK WRITE

| Field | Description |
|---------------|------------------------------------------------------------|
| Start bit (S) | Start Condition |
| I2C Address | 7-bit SMBus Address (2Dh) |
| Direction | 1-bit, 0 = Write |
| ACK | Acknowledge from SMBus slave |
| Offset MSB | Most significant byte of address to internal buffer (00h) |
| ACK | Acknowledge from SMBus slave |
| Offset LSB | Least significant byte of address to internal buffer (00h) |
| ACK | Acknowledge from SMBus slave |
| Count | Start Condition |
| ACK | Acknowledge from SMBus slave |
| Data 0 | First byte of data |
| ACK | Acknowledge from SMBus slave |
| Data 1 | Second byte of data |
| ACK | Acknowledge from SMBus slave |
| Data n | Last byte of data |
| ACK | Acknowledge from SMBus slave |
| Stop (P) | Stop Condition |

Note: The 7-bit address of the hub is **2Dh**, or the first byte is **5Ah** for an SMBus Write.

4.2 SMBus Block Read

The SMBus block read consists of an Address+Direction(0) byte with the 16-bit memory address, followed by a repeat Start signal and an Address+Direction(1) byte. The hub then starts to output the count (128 bytes) and the contents of the internal registers starting at the 16-bit address specified.

TABLE 4-2: SMBUS BLOCK READ

| Field | Description |
|----------------|------------------------------------------------------------|
| Start bit (S) | Start Condition |
| I2C Address | 7-bit SMBus Address (2Dh) |
| Direction | 1-bit, 0 = Write |
| ACK | Acknowledge from SMBus slave |
| Offset MSB | Most significant byte of address to internal buffer (00h) |
| ACK | Acknowledge from SMBus slave |
| Offset LSB | Least significant byte of address to internal buffer (00h) |
| ACK | Acknowledge from SMBus slave |
| Start bit (Sr) | Repeated Start Condition |
| I2C Address | 7-bit SMBus Address (2Dh) |
| Direction | 1-bit, 1 = Read |
| ACK | Acknowledge from SMBus slave |
| Count | Number of bytes to read from slave |
| ACK | Acknowledge from SMBus master |
| Data 0 | First byte of data from SMBus slave |
| ACK | Acknowledge from SMBus master |
| Data 1 | Second byte of data from SMBus slave |
| ACK | Acknowledge from SMBus master |
| Data n | Last data byte from SMBus slave |
| ACK | Acknowledge from SMBus master |
| Stop (P) | Stop Condition |

Note: The 7-bit address of the hub is **2Dh**, or the first byte is **5Ah** for a write and **5Bh** for a read.

4.3 Special Commands

Special commands can be sent in the place of the 16-bit address bytes. These commands are used to enumerate the hub, access the configuration registers, or reset the device. The commands consist of the 16-bit command followed by a 00h byte to terminate the command.

TABLE 4-3: SPECIAL SMBUS COMMANDS

| Operation | OPCODE | Description |
|--------------------------------------|--------|---------------------------------------------------------------------|
| Configuration Register Access | 9937h | Read and Write Configuration Registers |
| USB Attach | AA55h | Exit SOC_CONFIG and Enter HUB_CONFIG stage |
| USB Attach with SMBus Runtime Access | AA56h | Exit SOC_CONFIG and Enter HUB_CONFIG stage with SMBus slave enabled |
| OTP Program | 9933h | Permanently program configuration commands to the OTP |
| OTP Read | 9934h | Read the values of the OTP register |

Note: OTP Program and OTP Read commands reference data starting at configuration register 4800h.

4.4 Accessing Configuration Registers

The Configuration Register Access command allows the SMBus master to read or write to the internal registers of the hub. When the Configuration Register Access command is sent, the hub interprets the memory starting at offset 0000h as in [Table 4-4](#).

TABLE 4-4: MEMORY FORMAT FOR CONFIGURATION REGISTER ACCESS

| Buffer Address | Description | Notes |
|----------------|----------------|---------------------------------------------------------------------------------------------------|
| 0000h | Direction | 0 = Register Write, 1 = Register Read |
| 0001h | Data Length | Number of bytes to Read/Write, maximum of 128 bytes |
| 0002h-0005h | Memory Address | 32-bit memory address to read or write in big endian format |
| 0006h~0084h | Data | Data to write or read from the Memory Address, number of bytes specified in the Data Length field |

4.4.1 CONFIGURATION REGISTER WRITE EXAMPLE

To write to a configuration register:

1. Write the command block to the buffer area.
2. Execute the special Configuration Register Access command.

EXAMPLE 4-1: FORMATTING SMBUS MESSAGES TO SET HUB VID TO CUSTOM VALUE

The following example shows how the SMBus messages are formatted to set the VID of the hub to a custom value, 1234h:

1. Write the command block to the buffer area:

TABLE 4-5: SMBUS WRITE COMMAND BLOCK FOR REGISTER WRITE

| Byte | Value | Comment |
|------|-------|-------------------------------------------------------|
| 0 | 5Ah | Slave address plus write bit (2Dh left shifted by 1) |
| 1 | 00h | Buffer address MSB 0000h |
| 2 | 00h | Buffer address LSB 0000h |
| 3 | 08h | Number of bytes to write to command block buffer area |
| 4 | 00h | Write VID Register |
| 5 | 02h | Writing two bytes to VID register |
| 6 | BFh | VID is in register BF80_3000h |
| 7 | 80h | VID is in register BF80_3000h |
| 8 | 30h | VID is in register BF80_3000h |
| 8 | 00h | VID is in register BF80_3000h |
| A | 34h | LSB of Vendor ID 1234h |
| B | 12h | MSB of Vendor ID 1234h |

2. Execute the Configuration Register Access command:

TABLE 4-6: CONFIGURATION REGISTER ACCESS COMMAND

| Byte | Value | Comment |
|------|-------|------------------------|
| 0 | 5Ah | Address plus write bit |
| 1 | 99h | Command 9937h |
| 2 | 37h | Command 9937h |
| 3 | 00h | Command completion |

4.4.2 CONFIGURATION REGISTER READ EXAMPLE

To read configuration registers:

1. Write the command block to the buffer area.
2. Execute the Configuration Register Access command.
3. Read the data from the memory.

EXAMPLE 4-2: READING THE PID

The following example shows how to read the PID:

1. Write the data to the memory of the hub:

TABLE 4-7: SMBUS WRITE COMMAND BLOCK FOR REGISTER READ

| Byte | Value | Comment |
|------|-------|------------------------------------------------------|
| 0 | 5Ah | Slave address plus write bit (2Dh left shifted by 1) |
| 1 | 00h | Memory address 0000h |
| 2 | 00h | Memory address 0000h |
| 3 | 06h | Number of bytes to write to memory |
| 4 | 01h | Read Configuration Register |
| 5 | 02h | Reading two bytes from PID register |
| 6 | BFh | VID is in register BF80_3002h |
| 7 | 80h | VID is in register BF80_3002h |
| 8 | 30h | VID is in register BF80_3002h |
| 9 | 02h | VID is in register BF80_3002h |

2. Execute the Configuration Register Access command:

TABLE 4-8: CONFIGURATION REGISTER ACCESS COMMAND

| Byte | Value | Comment |
|------|-------|------------------------------------------------|
| 0 | 5Ah | Address plus write bit (2Dh left shifted by 1) |
| 1 | 99h | Command 9937h |
| 2 | 37h | Command 9937h |
| 3 | 00h | Command completion |

3. Read back data starting at memory offset 04h, which is where the Data byte starts:

TABLE 4-9: EXAMPLE SMBUS READ COMMAND

| Byte | Value | Comments |
|------|-------|---------------------------------------------------------|
| 0 | 5Ah | Slave address plus write bit (2Dh left shifted by 1) |
| 1 | 00h | Memory Address 0006h |
| 2 | 06h | Memory Address 0006h |
| 3 | 5Bh | Slave address plus read bit (2Dh left shifted by 1 + 1) |
| 4 | 08h | Device sends a count of 8 bytes |
| 5 | 16h | PID LSB |
| 6 | 49h | PID MSB |

Note: Although the device can send out 8 bytes, it is not necessary to read the 8 bytes. The SMBus Master can send a stop at any time.

4.5 SMBus Runtime

After the hub is enumerated (after USB Attach with SMBus Runtime Access), the same registers can be accessed during runtime.

5.0 OTP CONFIGURATION

The USB7002/USB705x hubs have 8k bytes of one time programmable (OTP) memory to enable customization and limited firmware updates in the field. OTP memory organization and OTP configuration are described in the next sections.

5.1 OTP Memory Organization

The OTP memory is divided into four regions as follows:

- OTP Flags
- Configuration Commands
- Blank Memory
- Configuration Index Records

[Figure 5-1](#) shows the OTP memory organization example. Each product will have unique default contents.

FIGURE 5-1: OTP MEMORY ORGANIZATION

| | 0h | 1h | 2h | 3h | 4h | 5h | 6h | 7h | 8h | 9h | Ah | Bh | Ch | Dh | Eh | Fh |
|-------|------------------|-----|-----|-----|-----|-----|-----|-----|------------------------------------|-----|-----|-----|-----|-----|-----|-----|
| 0000h | OTP Flags | | | | | | | | | | | | | | | |
| 0010h | | | | | | | | | | | | | | | | |
| 0020h | | | | | | | | | | | | | | | | |
| 0030h | | | | | | | | | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| 0040h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| 0050h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| | 00h | 00h | 00h | 00h | 00h | | | | Blank Memory | | | | 00h | 00h | 00h | 00h |
| ... | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| 1FC0h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| 1FD0h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | | | | | | | | |
| 1FE0h | | | | | | | | | Configuration Index Records | | | | | | | |
| 1FF0h | | | | | | | | | | | | | | | | |

5.1.1 OTP FLAGS

The first 2-4 bytes of the OTP memory are the OTP Flags indicating how many times the OTP has been programmed by the MPLAB Connect Configurator tool (when programming via SMBus, these bits are not updated). For an unprogrammed part, these two bytes are 0000h. Every time the OTP is programmed using MPLAB Connect Configurator, a bit is set. When the first OTP is programmed, this becomes 0001h, then 0003h, 0007h, and continues until all bits are set. After all OTP Flag bits are set, OTP programming is still possible as long as OTP space is available.

5.1.2 CONFIGURATION COMMANDS

The Configuration Commands section grows from the start of the OTP data. These are the commands that are appended every time a Program OTP command is sent through SMBus and can vary in length depending on how many configuration registers have been manipulated.

5.1.3 BLANK MEMORY

This memory region is initially 00h on an unprogrammed part and decreases in size as configuration commands and configuration index records are programmed.

5.1.4 CONFIGURATION INDEX RECORDS

The Configuration Index Records area contains Configuration Index Records that are automatically generated when the OTP data is programmed. A Configuration Index Record is always 8 bytes per OTP program and is appended to the back of the OTP memory space every time the Program OTP command is sent. It contains a checksum to confirm that the configuration command was written correctly as well as information on the location of the configuration commands within the OTP memory space and total length. The Configuration Index Record format is shown in [Figure 5-2](#).

The CheckSum algorithm for the CheckSum byte is Checksum8-Xor.

FIGURE 5-2: CONFIGURATION INDEX RECORD FORMAT

| BYTE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|--------------------|------------|------------|------------|----------|-------------|-----|------------|-----|
| Description | Signature | | | Checksum | CFG ADDRESS | | CFG LENGTH | |
| Contents | I (49h) | D (44h) | X (58h) | Checksum | MSB | LSB | MSB | LSB |

5.2 OTP Configuration Using MPLAB Connect Configurator

The easiest method to program the USB7002/USB705x Hub OTP is with the **MPLAB Connect Configurator** tool, available at: <http://www.microchip.com/design-centers/usb/mplab-connect-configurator>.

MPLAB Connect Configurator programs the configuration in the next available slot in the Configuration Commands area, programs the Index Record in the Configuration Index Records area, and updates the OTP Flags count field.

This tool can be used to generate a configuration file (.cfg) and to program the generated configuration file permanently to the hub's OTP memory space using USB commands.

Alternatively, the .cfg file can be constructed manually using a binary/hex editor. Follow the formatting instructions shown in [Table 1](#), and see the example in [Section 5.3.1, "OTP Configuration File Examples"](#).

5.3 OTP Configuration Using SMBus

The OTP memory can be programmed through the SMBus interface in the SOC_CONFIG stage (during start-up). The OTP memory is configured as a series of commands that manipulates the configuration registers. The USB7002/USB705x hubs have a total of 8 kB of OTP memory space, and each byte of OTP memory may be written only once. The OTP memory space can be successively written to (each programming instance appends the new command to the bottom of the OTP memory space) until the space is completely filled.

During the HUB_CONFIG stage, temporary OTP configuration registers are written to. The contents in the OTP configuration registers are then permanently loaded to the OTP memory space after sending a special OTP program command. These registers permanently change the default behavior of the hub during normal operation. These commands are stored into the OTP memory as shown in [Figure 5-1](#).

TABLE 1: OTP STORAGE COMMANDS

| Command | OPCODE | Length | Description |
|---------------------|---------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NULL | 00h | N/A | No action; advance memory counter by 1 and move to the next instruction. |
| MODIFY_BYTES | 01h-7Fh | OPCODE | Modifies the following bytes starting at the current memory address for length = OPCODE. The previously used SET_MODE command is used for selecting the bit operation. The default MODE is WRITE_BYTES if there is no preceding SET_MODE command. |
| SET_MEMORY_ADDRESS | 80h XXh XXh XXh XXh | N/A | Load the MEMORY_ADDRESS register with the four XXh XXh XXh XXh bytes. Example: 80h BFh 80h 30h 00h sets the memory address to BF80_3000h. |
| SKIP_MEMORY_WRITE | 81h-FDh | OPCODE [6:0] | Skip the length number of bytes starting at the location of the MEMORY_ADDRESS register. At the end of the operation, the MEMORY_ADDRESS register is incremented by length = OPCODE[6:0]. |
| SET_MODE_WRITE_BYTE | FEh 00 | N/A | If the byte following SET_MODE = 00h, all writes replace the memory value at that location. |
| SET_MODE_SET_BITS | FEh 01h | N/A | If the byte following SET_MODE = 01h, all writes are OR'ed in. This is a mechanism to set the selected bits in a register without changing the others. Set the bits to be set. |
| SET_MODE_CLEAR_BITS | FEh 02h | N/A | If the byte following SET_MODE = 02h, all writes are NAND'ed in. This is a mechanism to clear the selected bits in a register without changing the others. Set the bits to be cleared. |
| STOP | FFh | N/A | After the storage commands are complete, this indicates the termination of the command sequence. |

5.3.1 OTP CONFIGURATION FILE EXAMPLES

These examples show the hex data in a configuration file.

EXAMPLE 5-1: CONFIGURING PF28 AS AN OUTPUT GPIO

To configure PF28 as an output assuming that PF28 is already configured as a GPIO (as it is in USB7002, all CFG_STRAP options), the corresponding bit in the output enable register must be set, which from [Table 3-3](#) is GPIO92.

TABLE 5-1: SET BIT COMMAND SEQUENCE EXAMPLE

| Byte | Value | Comment |
|------|-------|---------------------------|
| 1 | 80h | SET_ADDRESS command |
| 2 | BFh | Address BF80_090Bh |
| 3 | 80h | Address BF80_090Bh |
| 4 | 09h | Address BF80_090Bh |
| 5 | 01h | Address BF80_090Bh |
| 6 | FEh | SET_MODE command |
| 7 | 01h | SET_BITS mode |
| 8 | 01h | Data length of 1 byte |
| 9 | 04h | Set PIO96_OEN[Bit 28] |
| 10 | FFh | Stop command |

EXAMPLE 5-2: CHANGING THE USB DOWNSTREAM PORT 1 BOOST REGISTER TO INCREASE THE HS OUTPUT CURRENT BY 5%

TABLE 5-2: WRITE BYTE COMMAND SEQUENCE EXAMPLE

| Byte | Value | Comment |
|------|-------|----------------------------------|
| 1 | 80h | SET_ADDRESS command |
| 2 | BFh | Address BF80_64CAh |
| 3 | 80h | Address BF80_64CAh |
| 4 | 64h | Address BF80_64CAh |
| 5 | CAh | Address BF80_64CAh |
| 6 | FEh | SET_MODE command |
| 7 | 01h | WRITE_BYTE mode |
| 8 | 01h | Data length of 1 byte |
| 9 | 03h | Increase HS output current by 5% |
| 10 | FFh | Stop command |

5.3.2 OTP CONFIGURATION VIA SMBUS

The following commands can be used to access and program the OTP memory. These can be used by an automated test equipment (ATE) equipment.

TABLE 5-3: SPECIAL OTP SMBUS COMMANDS

| Operation | OPCODE | Description |
|------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SMB_CMD OTP | 9933h | Execute OTP Command based on CMD_TYPE |
| SMB_CMD_READ OTP | 9934h | Read OTP register |
| SMB_CMD OTP ATE | 9939h | Execute OTP Command based on CMD_TYPE. This command is for use with ATE. Command success or failure is reported via signal pins. The device does not respond afterwards until reset. <ul style="list-style-type: none"> • Command status pin: PRT_PWR1 (0 = Passed, 1 = OTP Failed) • Command completion pin: PRT_PWR2 (0 = In progress, 1 = done) |

Note: Before any OTP commands can be executed, a data structure must be created in the memory using SMBus block writes.

5.3.3 SMBUS OTP COMMAND STRUCTURE

The following OTP command structure is used for accessing the OTP memory.

TABLE 5-4: SMBUS OTP COMMAND STRUCTURE

| Buffer Address | Description | Notes |
|----------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| BFD2_2100h | CMD_TYPE | Command Type is one of the commands in the OTP Command Type table. |
| BFD2_2101h | ADDR[15:0] | OTP Address to read from or write to; set to 0000h. |
| BFD2_2103h | LENGTH[15:0] | Number of bytes to transfer |
| BF90_7000h | Data | Data for OTP transaction. MULTI_HOST_CLK_EN and MHB_MEM_CLK_EN bits must be set before accessing the DATA_BUFFER . |
| BFD2_3419h | SMBusOTPResult | Result of OTP operation as specified in the OTP Return Status |

TABLE 5-5: OTP COMMAND TYPE

| Code | CMD_TYPE | Description |
|------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 00h | SMB OTP_RAW_PGM | <p>Raw OTP Programming mode *ADVANCED*</p> <p>OTP will be programmed starting at the OTP memory offset of ADDR for size LENGTH. The OTP memory at any location with the OTP can be programmed. No signature is generated.</p> <p>It is possible to corrupt existing configuration using this mode.</p> <p>A new OTP configuration block programmed using this mode will also need a valid signature to be manually added to the correct signature memory location.</p> <p>Status on completion:</p> <ul style="list-style-type: none"> • 00h = OTP was programmed and verified successfully. • 01h = OTP programming failed. |

TABLE 5-5: OTP COMMAND TYPE (CONTINUED)

| Code | CMD_TYPE | Description |
|------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 03h | SMB OTP PGM | <p>"Smart" OTP Programming mode</p> <p>This programs the OTP configuration block automatically after the last programmed OTP record.</p> <p>The hub will automatically generate and program the signature at the end of the OTP memory space in the next available memory space including the IDX signature, record checksum, start offset, and length.</p> <p>The LENGTH and DATA buffer must be initialized before issuing this command.</p> <p>Status on completion:</p> <ul style="list-style-type: none">• 00h = OTP was programmed and verified successfully.• 01h = OTP programming failed. |
| 05h | SMB OTP BLANKCHECK | <p>This verifies that the OTP is blank and has not been programmed.</p> <p>Status on completion:</p> <ul style="list-style-type: none">• 00h = PASS; OTP is blank and has not been programmed.• 01h = FAIL; OTP blank check failed. |
| 06h | SMB OTP RESET | <p>This resets the OTP core.</p> <p>Status on completion:</p> <ul style="list-style-type: none">• 00h = OTP_NO_ERROR |
| 07h | SMB OTP READ | <p>This command reads the number of bytes specified in the LENGTH field and stores them in data buffer.</p> <p>Status on completion:</p> <ul style="list-style-type: none">• 00h = OTP data was read successfully.• 01h = OTP read failed. |

5.3.4 STEPS FOR PROGRAMMING OTP USING SMBUS

1. Write the OTP memory structure.
2. Send the Execute OTP command.
3. Read SMBusOTPRResult.

EXAMPLE 5-3: SMBUS OTP “SMART” PROGRAMMING

The “Smart” OTP programming method allows an OTP configuration block to be programmed into the OTP with knowledge of the required memory offset within the OTP and without the manual generation and programming of the Configuration Index signature. In “Smart” OTP Programming mode, the hub automatically places the Configuration data into the next available memory space, and generates/programs the correct Configuration Index signature.

This example changes the PID LSB at BF803002h to 34h, and the PID MSB at BF803003h to 12h.

The OTP configuration data for this is 80 BF 80 30 02 02 34 12 FF.

Write OTP Memory Structure

1. Write 86, C7, 01, E0 to BF80_0B00h: 00 00 0A 00 04 BF 80 0B 00 86 C8 00 E0
2. Write SMBus Configuration Register Access Command: 5A 99 37 00
3. Resume HFC Operation: 00 00 07 00 01 BF 80 2C 02 C2
4. Write SMBus Configuration Register Access Command: 5A 99 37 00
5. Write OTP Patch to Data Area at BF90_7000h: 5A 00 00 0F 00 09 BF 90 70 00 80 BF 80 30 02 02 34 12 FF
6. Write SMBus Configuration Register Access Command: 5A 99 37 00
7. Write OTP “03” to BFD2_2100 to indicate “Smart OTP” programming to next available OTP space: 00 00 07 00 01 BF D2 21 00 03
8. Write SMBus Configuration Register Access Command: 5A 99 37 00
9. Write OTP patch length (09h) to BFD2_2103h: 00 00 08 00 02 BF D2 21 03 00 09
10. Write SMBus Configuration Register Access Command: 5A 99 37 00

Send the Execute OTP Command

11. Write to SMBus: 5A 99 33 00

Read SMBus OTP Result Register

12. Set the command block for status read at BFD2_3419h: 5A 00 00 06 01 01 BF D2 34 19
13. Write SMBus Configuration Register Access Command: 5A 99 37 00
14. Read Data: 5A 00 06 5B 08 XX

Note: XX is the status returned: 00 = Pass.

EXAMPLE 5-4: SMBUS OTP “RAW” PROGRAMMING (ADVANCED)

The Raw OTP Programming method allows any byte or block of bytes to be programmed within the hub OTP memory. Generally, when programming typical configuration memory blocks, the standard OTP programming method should be used.

The Raw OTP Programming feature can be used to intentionally corrupt a previously programmed configuration block's CheckSum byte in the Configuration Index signature. Doing this prevents the configuration block from being loaded. This technique can be used to recover a hub that was rendered non-functional by an incorrectly formatted configuration data block.

For example, if the CheckSum byte of the configuration block that needs to be prevented from being loaded is located at memory offset 1FEBh (meaning, it was the third configuration block to be programmed into the hub's OTP memory), then the following commands can be followed to overwrite that byte with an FFh to intentionally corrupt that byte.

Write OTP Memory Structure

1. Write 86, C7, 01, E0 to BF80_0B00h: 00 00 0A 00 04 BF 80 0B 00 86 C8 00 E0
2. Write SMBus Configuration Register Access Command: 5A 99 37 00
3. Resume HFC Operation: 00 00 07 00 01 BF 80 2C 02 C2
4. Write SMBus Configuration Register Access Command: 5A 99 37 00
5. Write OTP Patch to Data Area at BF90_7000h: 5A 00 00 07 00 01 BF 90 70 00 FF
6. Write SMBus Configuration Register Access Command: 5A 99 37 00
7. Write OTP “00” to BFD2_2100 to indicate “Smart OTP” programming to program to next available OTP space: 00 00 07 00 01 BF D2 21 00 00
8. Write SMBus Configuration Register Access Command: 5A 99 37 00
9. Write OTP patch memory offset (1FEBh) to BFD2_2101h to overwrite the data payload (FFh) to the third Configuration Index signature location: 00 00 08 00 02 BF D2 21 01 1F FE
10. Write SMBus Configuration Register Access Command: 5A 99 37 00
11. Write OTP patch length (01h) to BFD2_2103h: 00 00 08 00 02 BF D2 21 03 00 01
12. Write SMBus Configuration Register Access Command: 5A 99 37 00

Send the Execute OTP Command

13. Write to SMBus: 5A 99 33 00

Read SMBus OTP Result Register

14. Set the command block for status read at BFD2_3419h: 5A 00 00 06 01 01 BF D2 34 19
15. Write SMBus Configuration Register Access Command: 5A 99 37 00
16. Read Data: 5A 00 06 5B 08 XX

EXAMPLE 5-5: SMBUS OTP READ

The OTP memory of the hub can be read via SMBus in its entirety or in selected chunks.

The following example shows how to read back the entire OTP memory.

General Setup

1. Set up CLK_CTL_REG BF80_0B00h: 5A 00 00 0A 00 04 BF 80 0B 00 86 C8 00 E0
2. Write SMBus Configuration Register Access Command: 5A 99 37 00
3. Start-up HFC Execution, Length at BF80_2CC2h: 5A 00 00 07 00 01 BF 80 2C 02 C2
4. Write SMBus Configuration Register Access Command: 5A 99 37 00

Configure for read-back of first 4 kB of OTP memory space

5. Configure to take the first 4 kB of OTP memory and dump to BF90_7000h space: 5A 00 00 0B 00 05 BF D2 21 00 07 00 00 10 00
6. Write SMBus Configuration Register Access Command: 5A 99 37 00

Send the Execute OTP Command

7. Write to SMBus: 5A 99 33 00

Read SMBus OTP Result Register

8. Set the command block for status read at BFD2_3419h: 5A 00 00 06 01 08 BF D2 34 19
9. Write SMBus Configuration Register Access Command: 5A 99 37 00
10. Read Data: 5A 00 06 5B 06 XX

Note: XX is the status returned: 00 = Pass.

Read Back first 4 kB of OTP Memory

11. Set the command block for read-back of first 128 kB chunk of OTP starting from BF90_7000h: 5A 00 00 06 01 80 BF 90 70 00
12. Write SMBus Configuration Register Access Command: 5A 99 37 00
13. Read Data: 5A 00 06 5B 06 XX₀ - XX₁₂₇

Note: XX₀ - XX₁₂₇ is returned 128 kB of OTP memory

14. Set the command block for read-back next 128 kB chunk of OTP starting from BF90_7080h: 5A 00 00 06 01 80 BF 90 70 80
15. Write SMBus Configuration Register Access Command: 5A 99 37 00
16. Read Data: 5A 00 06 5B 06 XX₁₂₈ - XX₂₅₅

XX₁₂₈ - XX₂₅₅ is returned 128 kB of OTP memory

17. Set the command block for read-back next 128 kB chunk of OTP starting from BF90_7100h: 5A 00 00 06 01 80 BF 90 71 00
18. Write SMBus Configuration Register Access Command: 5A 99 37 00
19. Read Data: 5A 00 06 5B 06 XX₂₅₆ - XX₃₈₃

XX₂₅₆ - XX₃₈₃ is returned 128 kB of OTP memory

20. Continue until the first 4 kB of OTP memory is retrieved.

Configure for read-back of second 4 kB of OTP memory space

21. Configure to take the second 4 kB of OTP memory and dump to BF90_7000h space: 5A 00 00 0B 00 05 BF D2 21 00 07 10 00 10 00
22. Write SMBus Configuration Register Access Command: 5A 99 37 00

Send the Execute OTP Command

23. Write to SMBus: 5A 99 33 00

Read Back second 4 kB of OTP Memory

24. Set the command block for read-back next 128 kB chunk of OTP starting from BF90_7100h: 5A 00 00 06 01 80 BF 90 70 00
25. Write SMBus Configuration Register Access Command: 5A 99 37 00
26. Read Data: 5A 00 06 5B 06 XX_{4,096} – XX_{4,223}
XX_{4,096} – XX_{4,223} is returned 128 kB of OTP memory
27. Continue until the second 4 kB of OTP memory is retrieved.

5.4 OTP Configuration via USB

The following are the steps to configure OTP via USB:

1. Read OTP Setup Transaction
2. Set OTP Program Code
3. Program OTP Transaction to Program OTP Configuration Data to OTP
4. Get Status OTP Transaction

5.4.1 READ OTP SETUP TRANSACTION

To program OTP via USB, the entire OTP memory contents must be read to obtain the correct memory offset location for the OTP configuration block and the signature. Refer to the [Section 5.1, "OTP Memory Organization"](#) for the OTP memory organization.

The new configuration block should be programmed to the next byte following the end of the most recently programmed configuration block (Configuration Command blocks work forward from the beginning of the OTP memory space). The new Configuration Index signature should begin 8 bytes before the start of the most recently programmed Configuration Index signature (signatures are added backwards from the end of the memory space).

Note: Two to four Bytes at the very beginning of the OTP memory are left intentionally blank at the time of production. The MPLAB Connect Configurator tool uses these bytes to keep track of the number of times the tool has been used to update the OTP memory. When programming OTP via USB manually, these bits may be optionally used to keep track of the number of additional times the hub OTP memory has been programmed. The hub FW does not actually use these bytes for any purpose.

Issue this command to read the OTP memory.

TABLE 5-6: OTP READ SETUP PACKET

| Setup Pkt | Value | Description |
|---------------|-------------|-------------------------------------------------------------------------------------|
| bmRequestType | 0xC1 | Device-to-host to data transfer, using vendor-specific command, targeting interface |
| bRequest | 0x01 | CMD OTP READ |
| wValue | OTP_ADDRESS | Address of the OTP ROM to be read |
| wIndex | 0x00 | Reserved |
| wLength | Data Length | Length of data to be read |

Command phase: Receives the setup packet with the parameters specified above.

Data phase: Sends the data bytes of length wLength from address wValue.

Status phase:

- STALL - on read error
- ACK - on successful completion of command

5.4.2 SET OTP PROGRAM CODE

The OTP memory can be programmed by either the PROGRAM command or the PROGRAMVERIFY command. CMD OTP_SET_PROGRAM_MODE selects the internal command that the ROM will issue to the OTP during subsequent CMD OTP_PROGRAM commands.

The default mode in the ROM is PROGRAMVERIFY (without requiring the Set OTP Program Mode command to be issued always).

TABLE 5-7: SET OTP PROGRAM MODE SETUP PACKET

| Setup Pkt | Value | Description |
|---------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| bmRequestType | 0x41 | Host-to-device to data transfer, using vendor-specific command, targeting interface |
| bRequest | 0xF1 | CMD OTP_SET_PROGRAM_MODE |
| wValue | Programming Option | Indicates if the future CMD OTP_PROGRAM commands will issue the PROGRAMVERIFY or PROGRAM command <ul style="list-style-type: none"> • 0x01 - PGMVFY • 0x02 - PROGRAM |
| wIndex | 0x0000 | Reserved |
| wLength | Data Length | No Data Command |

Command phase: Receives the setup packet as specified in the table.

Status phase:

- ACK - On successful completion of the command

5.4.3 PROGRAM OTP TRANSACTION TO PROGRAM OTP CONFIGURATION DATA TO OTP

Method 1: Program the entire 8 kB in a single step.

This method allows the OTP to be updated with a single program command, but requires transferring 8 kB to the hub before sending the program command.

To simplify the update process, it is recommended to first read back the entire 8 kB OTP memory space, insert the new Configuration data block and index signature to the read back file, and transfer the entire amended 8 kB back to the hub. Overwriting previously written to bytes with the same redundant data is supported and will have no negative effect.

With this method, OTP_ADDRESS is always 0x000, and wLength is always 0x1FFF.

Method 2: Program only the new configuration data block and signature index in two separate programming steps.

This method allows the hub OTP to be updated with the minimum amount of data transfer possible, but requires two separate program commands to achieve.

An alternate method is to perform an OTP memory dump, locate the offset of the configuration data block, and program only the new configuration block to the proper memory offset. Then, in a separate programming step, add the new configuration index signature to the correct memory offset.

An optional read-back step can be performed to ensure the data is correctly stored.

TABLE 5-8: OTP PROGRAM SETUP PACKET

| Setup Pkt | Value | Description |
|---------------|-------------|----------------------------------------------------------------------------------|
| bmRequestType | 0x41 | Host-to-device data transfer, using vendor-specific command, targeting interface |
| bRequest | 0x00 | CMD OTP PROGRAM |
| wValue | OTP_ADDRESS | Address of the OTP memory for the Configuration Data block to be written |
| wIndex | 0x00 | Reserved |
| wLength | Data Length | Length of data to be written |

Command phase: Receives the setup packet with the parameters specified above.

Data phase: Receives the data bytes of length wLength and programs the OTP accordingly.

Status phase:

- STALL - on programming error
- ACK - on successful completion of programming

Use CMD OTP GET STATUS to get the status for more information on the failure.

Note: Programming OTP via USB requires that a valid signature at the end of OTP is also manually generated and programmed to the correct memory location. There is no automated signature generation option when programming OTP via USB. For a configuration block to be loaded by the hub FW, steps 5 and 6 must also be followed correctly.

5.4.4 GET STATUS OTP TRANSACTION

To ensure the previous Configuration block was programmed to OTP successfully, issue this command to get the OTP status.

TABLE 5-9: OTP GET STATUS SETUP PACKET

| Setup Pkt | Value | Description |
|---------------|--------|-------------------------------------------------------------------------------------|
| bmRequestType | 0xC1 | Device-to-host to data transfer, using vendor-specific command, targeting interface |
| bRequest | 0x02 | CMD OTP GET STATUS |
| wValue | 0x0000 | Address of the OTP ROM to be read |
| wIndex | 0x0000 | Reserved |
| wLength | 0x01 | One byte status to be returned |

Command phase: Receives the setup packet with the parameters specified above.

Data phase: Sends the status byte.

Status phase:

- STALL - on read error
- ACK - on successful completion of command

The status code returned is shown in [Table 5-10](#).

TABLE 5-10: OTP STATUS CODES

| Status Code | Description |
|-------------|-------------------------------|
| 0x00 | Command successful completion |
| 0x01 | Generic error |

EXAMPLE 5-6: OTP PROGRAMMING EXAMPLE

An OTP patch is generated to change the value of register 0xBF80_3000 = 0x34 and 0xBF80_3001 = 0x12, such that the VID is changed to 0x1234.

The OTP contents for this patch would be:

80 BF 80 30 00 FE 00 02 34 12 FF

Step 1: An OTP memory read-back is performed, and the following data is returned:

FIGURE 5-3: EXAMPLE RETURNED OTP READ

| | 0h | 1h | 2h | 3h | 4h | 5h | 6h | 7h | 8h | 9h | Ah | Bh | Ch | Dh | Eh | Fh |
|------------------|------------------|-----|-----|-----|-----|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| OTP Flags | | | | | | | | | | | | | | | | |
| 0000h | OTP Flags | 80 | BF | CF | 80 | 8E | 10 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 0B |
| 0010h | 12 | 1A | 04 | 03 | 01 | 02 | 80 | BF | D2 | 2E | 1A | 10 | 00 | 00 | 00 | 00 |
| 0020h | 00 | 00 | 00 | 0B | 24 | 0B | 12 | 1A | 04 | 03 | 01 | 02 | FFh | 00h | 00h | 00h |
| 0030h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| 0040h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| 0050h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| | 00h | 00h | 00h | 00h | 00h | Blank Memory | | | | | | | | 00h | 00h | 00h |
| ... | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| 1FC0h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| 1FD0h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| 1FE0h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| 1FF0h | 00h | 00h | 00h | 00h | 00h | 00h | 49h | 44h | 58h | D8h | 00h | 12h | 00h | 2Dh | | |

Step 2: The Configuration Data should be placed as shown in orange in [Figure 5-4](#) at memory offset 003Dh - 0047h.

The Configuration Index signature should be placed in the next available signature location as shown in orange in [Figure 5-4](#) at memory offset 1FF0h-1FF7h.

FIGURE 5-4: OTP MEMORY WITH NEW CONFIGURATION DATA INSERTED

| | 0h | 1h | 2h | 3h | 4h | 5h | 6h | 7h | 8h | 9h | Ah | Bh | Ch | Dh | Eh | Fh |
|------------------|------------------|-----|-----|-----|-----|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| OTP Flags | | | | | | | | | | | | | | | | |
| 0000h | OTP Flags | 80 | BF | CF | 80 | 8E | 10 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 0B |
| 0010h | 12 | 1A | 04 | 03 | 01 | 02 | 80 | BF | D2 | 2E | 1A | 10 | 00 | 00 | 00 | 00 |
| 0020h | 00 | 00 | 00 | 0B | 24 | 0B | 12 | 1A | 04 | 03 | 01 | 02 | FFh | 80h | BFh | 80h |
| 0030h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| 0040h | 30h | 00h | Feh | 00h | 02h | 34h | 12h | FFh | 00h |
| 0050h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| | 00h | 00h | 00h | 00h | 00h | Blank Memory | | | | | | | | 00h | 00h | 00h |
| ... | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| 1FC0h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| 1FD0h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| 1FE0h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h | 00h |
| 1FF0h | 49h | 44h | 58h | AAh | 00h | 3Dh | 00h | 0Bh | 49h | 44h | 58h | D8h | 00h | 12h | 00h | 2Dh |

The signature data is generated based upon the data contents, a checksum, the location that it is placed within the OTP memory, and the length. Hence, the signature for this example is shown in [Figure 5-5](#).

FIGURE 5-5: EXAMPLE CONFIGURATION INDEX

| BYTE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|--------------------|------------|------------|------------|----------|-------------|------------|-----|-----|
| Description | Signature | | | Checksum | CFG ADDRESS | CFG LENGTH | | |
| Contents | I (49h) | D (44h) | X (58h) | AAh | 00h | 3Dh | 00h | 0Bh |

Step 3: Send the CMD OTP PROGRAM command with the 8 kB of amended OTP data as the data payload for the USB transaction.

Step 4: Verify that programming was successful by sending CMD OTP GET STATUS and verifying that the returned payload is 0x00.

Step 5: Perform another OTP memory read to confirm programming was successful.

5.5 Memory Access during Runtime via USB

The hub memory mapped registers can be accessed during runtime via USB.

Note: Not all registers should be modified during runtime as this could affect normal operation.

TABLE 5-11: MEMORY WRITE SETUP PACKET

| Setup Pkt | Value | Description |
|---------------|-------------|--------------------------------------------------------------------|
| bmRequestType | 0x40 | Host-to-device data transfer, vendor class, targeted to interface |
| bRequest | 0x03 | CMD_MEMORY_WRITE |
| wValue | ADDR_LO | Lower 16 bits of the Target Memory Address in Little Endian Format |
| wIndex | ADDR_HI | Upper 16 bits of the Target Memory Address in Little Endian Format |
| wLength | Data Length | Length of data to be written |

Command phase: Receives the setup packet with the parameters specified above.

Data phase: Receives the data bytes of length wLength and writes data starting at the target memory address.

Status phase:

- ACK - on successful completion of memory write

TABLE 5-12: MEMORY READ SETUP PACKET

| Setup Pkt | Value | Description |
|---------------|-------------|--------------------------------------------------------------------|
| bmRequestType | 0xC0 | Device-to-host data transfer, vendor class, targeted to interface |
| bRequest | 0x04 | CMD_MEMORY_READ |
| wValue | ADDR_LO | Lower 16 bits of the Target Memory Address in Little Endian Format |
| wIndex | ADDR_HI | Upper 16 bits of the Target Memory Address in Little Endian Format |
| wLength | Data Length | Length of data to read |

Command phase: Receives the setup packet with the parameters specified above.

Data phase: Sends the data bytes of length wLength starting from the target memory address.

Status phase:

- ACK - on successful completion of programming

EXAMPLE 5-7: USB MEMORY WRITE

This example changes the PID at location BF80_3002h.

- Memory Write SETUP Phase Transaction:** The USB host sends the SETUP packet [Table 5-13](#) and [Figure 5-6](#) to the Hub Feature Controller at Endpoint 0.

TABLE 5-13: MEMORY WRITE SETUP PACKET

| Setup Pkt | Value | | Description | | | | | | | | | |
|---------------|--------|--|--------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|
| bmRequestType | 0x40 | | Host-to-device data transfer, vendor class | | | | | | | | | |
| bRequest | 0x03 | | CMD_MEMORY_WRITE | | | | | | | | | |
| wValue | 0x3002 | | Lower 16 bits of the Target Memory Address in Little Endian Format | | | | | | | | | |
| wIndex | 0xBF80 | | Upper 16 bits of the Target Memory Address in Little Endian Format | | | | | | | | | |
| wLength | 0x0002 | | Length of data to be written. | | | | | | | | | |

FIGURE 5-6: MEMORY WRITE SETUP TRANSACTION

| | | | | | | | | | | | | | | | | | |
|-------------|--------|-------|------|-------|---------|------|------------|---------|-----------|------------|-----------------|----------|-----------------|-----------------|------------|------------|-----------------|
| Transaction | H | SETUP | ADDR | ENDP | T | D | Tp | R | bRequest | wValue | wIndex | wLength | ACK | Time Stamp | | | |
| 6553 | S | 0xB4 | 53 | 0 | 0 | H->D | V | D | 0x03 | 0x3002 | 0xBF80 | 2 | 0x4B | 5 . 586 873 350 | | | |
| Cho | Packet | H | H | SETUP | ADDR | ENDP | CRC5 | Pkt Len | | Duration | Idle | | Time Stamp | | | | |
| Cho | 13983 | | | 0xB4 | 53 | 0 | 0x1D | 8 | | 133.333 ns | 198.660 ns | | 5 . 586 873 350 | | | | |
| Cho | Packet | H | H | DATA0 | Data | | | | CRC16 | Pkt Len | | Duration | Idle | Time Stamp | | | |
| Cho | 13984 | | | 0xC3 | 40 | 03 | 02 | 30 | 80 | BF | 02 | 00 | 0x0B66 | 16 | 266.667 ns | 301.330 ns | 5 . 586 873 682 |
| Cho | Packet | H | H | ACK | Pkt Len | | Duration | | Time | | Time Stamp | | | | | | |
| Cho | 13985 | | | 0x4B | 6 | | 100.000 ns | | 46.982 us | | 5 . 586 874 250 | | | | | | |

- Memory Write Data Phase OUT Transaction:** The USB host sends two data bytes to set BF803002 = 5678h.

FIGURE 5-7: MEMORY WRITE OUT TRANSACTION

| | | | | | | | | | | | | | |
|-------------|--------|------|------|-------|---------|---------|------------|---------|-----------|-----------------|-----------------|------------|-----------------|
| Transaction | H | OUT | ADDR | ENDP | T | Data | | NYET | | Time Stamp | | | |
| 6559 | S | 0x87 | 53 | 0 | 1 | 2 bytes | | 0x69 | | 5 . 586 922 982 | | | |
| Cho | Packet | H | H | OUT | ADDR | ENDP | CRC5 | Pkt Len | | Duration | Idle | | Time Stamp |
| Cho | 13998 | | | 0x87 | 53 | 0 | 0x1D | 8 | | 133.333 ns | 200.660 ns | | 5 . 586 922 982 |
| Cho | Packet | H | H | DATA1 | Data | CRC16 | Pkt Len | | Duration | Idle | | Time Stamp | |
| Cho | 13999 | | | 0xD2 | 78 | 56 | 0x3A8E | 10 | | 166.667 ns | 333.330 ns | | 5 . 586 923 316 |
| Cho | Packet | H | H | NYET | Pkt Len | | Duration | | Time | | Time Stamp | | |
| Cho | 14000 | | | 0x69 | 6 | | 100.000 ns | | 66.750 us | | 5 . 586 923 816 | | |

3. **Memory Write Status Phase IN Transaction:** The USB host sends an IN packet to complete the transfer. The Hub Feature Controller responds with a zero length data packet.

FIGURE 5-8: MEMORY WRITE IN TRANSACTION

| Transaction | H | IN | ADDR | ENDP | T | Data | ACK | Time Stamp |
|-------------|--------|------|------|-------|---------|------------|------------|-----------------|
| 6564 | S | 0x96 | 53 | 0 | 1 | 0 bytes | 0x4B | 5 . 586 990 566 |
| Cho | Packet | H | H | IN | ADDR | ENDP | CRC5 | Pkt Len |
| | 14009 | | | 0x96 | 53 | 0 | 0x1D | 8 |
| | | | | | | | Duration | Idle |
| | | | | | | | 133.333 ns | 332.660 ns |
| | | | | | | | Time Stamp | 5 . 586 990 566 |
| Cho | Packet | H | H | DATA1 | Data | CRC16 | Pkt Len | Duration |
| | 14010 | | | 0xD2 | 0 bytes | 0x0000 | 8 | 133.333 ns |
| | | | | | | | Idle | Time Stamp |
| | | | | | | | 716.660 ns | 5 . 586 991 032 |
| Cho | Packet | H | H | ACK | Pkt Len | Duration | Time | Time Stamp |
| | 14011 | | | 0x4B | 6 | 100.000 ns | -93.666 us | 5 . 586 991 882 |

EXAMPLE 5-8: USB MEMORY READ

This example reads the PID at location BF80_3002h.

1. **Memory Read SETUP Phase Transaction:** The USB host sends the SETUP packet below to the Hub Feature Controller at Endpoint 0.

TABLE 5-14: READ SETUP PACKET

| Setup Pkt | Value | Description |
|---------------|--------|--------------------------------------------------------------------|
| bmRequestType | 0xC0 | Device-to-host data transfer, vendor class |
| bRequest | 0x04 | CMD_MEMORY_READ |
| wValue | 0x3002 | Lower 16 bits of the Target Memory Address in Little Endian Format |
| wIndex | 0xBF80 | Upper 16 bits of the Target Memory Address in Little Endian Format |
| wLength | 0x0002 | Length of data to read |

FIGURE 5-9: MEMORY READ SETUP TRANSACTION

| Transaction | H | SETUP | ADDR | ENDP | T | D | Tp | R | bRequest | wValue | wIndex | wLength | ACK | Time Stamp |
|-------------|--------|-------|------|-------|---------|------------|-----------|------------------|------------|----------|--------|------------|------------------|------------------|
| 6503 | S | 0xB4 | 53 | 0 | 0 | D>H | V | D | 0x04 | 0x3002 | 0xBF80 | 2 | 0x4B | 17 . 311 469 566 |
| Cho | Packet | H | H | SETUP | ADDR | ENDP | CRC5 | Pkt Len | Duration | | | Idle | Time Stamp | |
| | 13984 | | | 0xB4 | 53 | 0 | 0x1D | 8 | 133.333 ns | | | 200.660 ns | 17 . 311 469 566 | |
| Cho | Packet | H | H | DATA0 | Data | | | CRC16 | Pkt Len | Duration | | | Idle | Time Stamp |
| | 13985 | | | 0xC3 | C0 | 04 | 02 | 30 | 80 | BF | 02 | 00 | 0x7563 | 16 |
| Cho | Packet | H | H | ACK | Pkt Len | Duration | Time | Time Stamp | | | | | | |
| | 13986 | | | 0x4B | 6 | 100.000 ns | 54.084 us | 17 . 311 470 482 | | | | | | |

FIGURE 5-10: MEMORY READ IN TRANSACTION

| Transaction | H | IN | ADDR | ENDP | T | Data | ACK | Time Stamp |
|-------------|--------|------|------|------|-------|---------|------------|---------------------------|
| 6509 | S | 0x96 | 53 | 0 | 1 | 2 bytes | 0x4B | 17 . 311 524 566 |
| Cho | Packet | H | H | S | IN | ADDR | ENDP | CRC5 Pkt Len |
| 13998 | | | | | 0x96 | 53 | 0 | 0x1D 8 |
| Cho | Packet | H | D | S | DATA1 | Data | CRC16 | Pkt Len |
| 13999 | | | | | 0xD2 | 78 56 | 0x3A8E | 10 |
| Cho | Packet | H | H | S | ACK | Pkt Len | Duration | Time Stamp |
| 14000 | | | | | 0x4B | 6 | 100.000 ns | 7.900 us 17 . 311 525 916 |

- Memory Read Data Phase IN Transaction:** The USB host sends an IN packet to read the data. The Hub Feature Controller returns two bytes of data to complete the transfer. Data 5678h is read from location BF803002h.
- Memory Read Status Phase OUT Transaction:** The USB host sends an OUT packet to complete the transfer. The Hub Feature Controller responds with a zero length data packet.

FIGURE 5-11: MEMORY READ OUT TRANSACTION

| Transaction | H | OUT | ADDR | ENDP | T | Data | ACK | Time Stamp |
|-------------|--------|------|------|------|-------|---------|------------|----------------------------|
| 6510 | S | 0x87 | 53 | 0 | 1 | 0 bytes | 0x4B | 17 . 311 533 816 |
| Cho | Packet | H | H | S | OUT | ADDR | ENDP | CRC5 Pkt Len |
| 14001 | | | | | 0x87 | 53 | 0 | 0x1D 8 |
| Cho | Packet | H | D | S | DATA1 | Data | CRC16 | Pkt Len |
| 14002 | | | | | 0xD2 | 0 bytes | 0x0000 | 8 |
| Cho | Packet | H | H | S | ACK | Pkt Len | Duration | Time Stamp |
| 14003 | | | | | 0x4B | 6 | 100.000 ns | 49.560 ms 17 . 311 534 632 |

6.0 HUB PRODUCT IDS

6.1 Hub Feature Controller (UDC0)

The Hub Feature Controller (UDC0) is enabled by default, thus reported as a non-removable device.

The Hub Feature Controller exposes different USB interfaces depending on the state of the configuration straps (CONFIG_STRAPx pins), enabling the features relevant to the selected PFx pins. Exposing a different PID for different configurations is required so that the correct USB client drivers are loaded.

The base PID is maintained as 0x7040. However, the last nibble is maintained to reflect the enabled features as shown in [Table 6-1](#), with bit 0 indicating the presence of I²S HID, bit 1 indicating the presence of I²S Audio, bit 2 indicating the presence of CDC, and bit 3 indicating the presence of Generic USB Device (WinUSB on Windows).

TABLE 6-1: HUB FUNCTION CONTROLLER (UDC0) PIDS

| WinUSB | CDC | I ² S Audio | I ² S HID | UDC0 Device Configuration | PID |
|--------|-----|------------------------|----------------------|-------------------------------------------------------------------------------------------------------------|-------|
| No | No | No | No | No interface present, will not enumerate | NA |
| No | No | No | Yes | Invalid | NA |
| No | No | Yes | No | I ² S Audio | 7042h |
| No | No | Yes | Yes | I ² S Audio, I ² S HID | 7043h |
| No | Yes | No | No | CDC Data, CDC Control | 7044h |
| No | Yes | No | Yes | Invalid | NA |
| No | Yes | Yes | No | CDC Data, CDC Control, I ² S Audio | 7046h |
| No | Yes | Yes | Yes | CDC Data, CDC Control, I ² S Audio, I ² S HID | 7047h |
| Yes | No | No | No | Generic USB Device (WinUSB on Windows) | 7040h |
| Yes | No | No | Yes | Invalid | NA |
| Yes | No | Yes | No | Generic USB Device (WinUSB on Windows) | 704Ah |
| Yes | No | Yes | Yes | Generic USB Device (WinUSB on Windows), I ² S Audio, I ² S HID | 704Bh |
| Yes | Yes | No | No | Generic USB Device (WinUSB on Windows), CDC Data, CDC Control | 704Ch |
| Yes | Yes | No | Yes | Invalid | NA |
| Yes | Yes | Yes | No | Generic USB Device (WinUSB on Windows), CDC Data, CDC Control, I ² S Audio | 704Eh |
| Yes | Yes | Yes | Yes | Generic USB Device (WinUSB on Windows), CDC Data, CDC Control, I ² S Audio, I ² S HID | 704Fh |

6.2 Hub PID Selection

[Table 6-2](#) shows the Primary Hub, Secondary Hub, UDC1, and UDC2 PIDs based on part number.

TABLE 6-2: PID SELECTION OPTIONS

| Device | Package | HUB PID | Multi-Host Endpoint Reflector UDC1 PID (Upstream Port Side) | Multi-Host Endpoint Reflector UDC2 PID (Downstream Port Side) |
|---------|---------|---------|-------------------------------------------------------------|---------------------------------------------------------------|
| USB7002 | QFN100 | 7002h | 7010h | 7020h |
| USB7050 | QFN100 | 7050h | 7010h | 7020h |
| USB7051 | QFN100 | 7051h | 7010h | 7020h |
| USB7052 | QFN100 | 7052h | 7010h | 7020h |
| USB7056 | QFN100 | 7056h | 7010h | 7020h |

APPENDIX A: APPLICATION NOTE REVISION HISTORY**TABLE A-1: REVISION HISTORY**

| Revision Level & Date | Section/Figure/Entry | Correction |
|---------------------------|----------------------|------------|
| DS00002810A (10-23-18) | Initial release | |

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