# Falcon MC6S16 V1.0r0.0 FPGA 开发项目计划书

# FPGA管脚定义

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| ***FPGA SIGNAL GROUP*** | ***FPGA PIN NAME*** | ***PIN NUMBER*** | ***Direction*** | ***FPGA 板 Note*** | | | |
| FPGA板控制信号 | BASE\_CLOCK | M9 | IN | 50M时钟 | | | |
| I2C\_SCL | T5 | OUT | 接AT24C02用于加密 | | | |
| I2C\_SDA | N5 | IO |  | | | |
| LED0 | K12 | OUT | 输出‘0’，点亮FPGA状态灯为绿色 | | | |
| SWITCH\_SET0 | M3 | IN | 4位拨码开关 | | | |
| SWITCH\_SET1 | F5 | IN |  | | | |
| SWITCH\_SET2 | N4 | IN |  | | | |
| SWITCH\_SET3 | R2 | IN |  | | | |
| LED2\_RED | E1 | OUT | FPGA板LED2三色指示灯，'0'点亮 | | | |
| LED2\_GREEN | B1 | OUT |  | | | |
| LED2\_BLUE | B2 | OUT |  | | | |
| LED\_LIGHT0 | B3 | OUT | FPGA板LED1四色指示灯红色,'0'点亮 | | | |
| LED\_LIGHT1 | A2 | OUT | FPGA板LED1四色指示灯绿色 | | | |
| LED\_LIGHT2 | C3 | OUT | FPGA板LED1四色指示灯蓝色 | | | |
| LED\_LIGHT3 | A3 | OUT | FPGA板LED1四色指示灯黄色 | | | |
| DEBUG\_TXD | C1 | OUT | FPGA板设置串口，波特率921600、8、1 | | | |
| DEBUG\_RXD | C2 | IN |  | | | |
| EN\_SCL | D3 | OUT | 接AT88SC0204C用于加密 | | | |
| EN\_SDA | E4 | IO |  | | | |
| USB\_TXD | D1 | IN | FPGA板载USB串口，废弃不用 | | | |
| USB\_RXD | E3 | IN |  | | | |
| BUTTON\_PWM | F4 | OUT | 蜂鸣器驱动 | | | |
| B50612控制信号 | MDC | M4 | OUT |  | | | |
| MDIO | N1 | IO |  | | | |
| RJ\_LED1 | P1 | OUT |  | | | |
| RJ\_LED2 | E2 | OUT |  | | | |
| LED1 | M2 | 不确定 |  | | | |
| LED2 | M1 | 不确定 |  | | | |
| LED3 | K2 | 不确定 |  | | | |
| LED4 | K1 | 不确定 |  | | | |
| PHYA0 | K5 | 不确定 |  | | | |
| PHY\_RST\_N | L3 | OUT |  | | | |
| GTXCLK | K3 | OUT |  | | | |
| TX\_EN | G1 | OUT |  | | | |
| TXD0 | J3 | OUT |  | | | |
| TXD1 | J4 | OUT |  | | | |
| TXD2 | H2 | OUT |  | | | |
| TXD3 | J1 | OUT |  | | | |
| RXCLK | F2 | IN |  | | | |
| RXDV | F3 | IN |  | | | |
| RXD0 | H3 | IN |  | | | |
| RXD1 | H4 | IN |  | | | |
| RXD2 | G3 | IN |  | | | |
| RXD3 | F1 | IN |  | | | |
|  |  |  |  |  |  |  |  |
| ***FPGA SIGNAL GROUP*** | ***FPGA PIN NAME*** | ***PIN NUMBER*** | ***Direction*** | ***FPGA 板 Note*** | ***伺服板 Signal Name*** | ***Direction*** | ***伺服板 Note*** |
| 伺服板控制信号 | CON\_00 | A4 |  |  |  |  |  |
| CON\_01 | B5 |  |  | LED0 | OUT | SH模式指示灯。红色，'0'点亮 |
| CON\_02 | A5 |  |  |  |  |  |
| CON\_03 | D5 |  |  | LED1 | OUT | SH模式指示灯。绿色 |
| CON\_04 | C5 |  |  |  |  |  |
| CON\_05 | B6 |  |  | LED2 | OUT | SH模式指示灯。蓝色 |
| CON\_06 | A6 |  |  |  |  |  |
| CON\_07 | C7 |  |  | LED3 | OUT | SH模式指示灯。黄色 |
| CON\_08 | A7 |  |  |  |  |  |
| CON\_09 | D6 |  |  | LED4 | OUT | WH模式指示灯。红色 |
| CON\_10 | C6 |  |  |  |  |  |
| CON\_11 | B8 |  |  | LED5 | OUT | WH模式指示灯。绿色 |
| CON\_12 | A8 |  |  |  |  |  |
| CON\_13 | C9 |  |  | LED6 | OUT | WH模式指示灯。蓝色 |
| CON\_14 | A9 |  |  |  |  |  |
| CON\_15 | B10 |  |  | LED7 | OUT | WH模式指示灯。黄色 |
| CON\_16 | A10 |  |  |  |  |  |
| CON\_17 | C10 |  |  | SW\_00 | IN | 视恒模式SH模式，无效为‘1’ |
| CON\_18 | D8 |  |  |  |  |  |
| CON\_19 | C8 |  |  |  |  |  |
| CON\_20 | C11 |  |  |  |  |  |
| CON\_21 | A11 |  |  | SW\_01 | IN | 维宏模式WH模式，两种模式不可能同时有效。互斥关系 |
| 对外电机控制信号 | CON\_22 | D9 |  |  |  |  |  |
| CON\_23 | B12 |  |  |  |  |  |
| CON\_24 | A12 |  |  |  |  |  |
| CON\_25 | C13 |  |  |  |  |  |
| CON\_26 | A13 |  |  |  |  |  |
| CON\_27 | B14 |  |  |  |  |  |
| CON\_28 | A14 |  |  |  |  |  |
| CON\_29 | D11 |  |  |  |  |  |
| CON\_30 | D12 |  |  |  |  |  |
| CON\_31 | E13 |  |  |  |  |  |
| CON\_32 | B15 |  |  |  |  |  |
| CON\_33 | B16 |  |  |  |  |  |
| CON\_34 | D14 |  |  |  |  |  |
| CON\_35 | D16 |  | FPGA寄存器控制 | X1\_PULS | OUT | X方向电机驱动脉冲 |
| CON\_36 | F13 |  | FPGA寄存器控制 | X1\_DIR | OUT | X方向电机驱动方向 |
| CON\_37 | F14 |  | FPGA寄存器控制 | Y1\_PULS | OUT | Y1方向电机驱动脉冲 |
| CON\_38 | C15 |  | FPGA寄存器控制 | Y1\_DIR | OUT | Y1方向电机驱动方向 |
| CON\_39 | C16 |  | FPGA寄存器控制 | Z1\_PULS | OUT | Z方向电机驱动脉冲 |
| CON\_40 | E16 |  | FPGA寄存器控制 | Z1\_DIR | OUT | Z方向电机驱动方向 |
| CON\_41 | E15 |  |  |  |  |  |
| CON\_42 | F15 |  |  |  |  |  |
| CON\_43 | F16 |  |  |  |  |  |
| CON\_44 | G14 |  |  |  |  |  |
| CON\_45 | G16 |  | FPGA寄存器控制 | Y2\_PULS | OUT | Y1方向电机驱动脉冲 |
| CON\_46 | H15 |  | FPGA寄存器控制 | Y2\_DIR | OUT | Y1方向电机驱动方向 |
| CON\_47 | H16 |  | FPGA寄存器控制 | MA\_LOW | OUT | 主轴低速 |
| CON\_48 | H13 |  | FPGA寄存器控制 | MA\_MIDU | OUT | 主轴中速 |
| CON\_49 | H14 |  | FPGA寄存器控制 | MA\_HIGH | OUT | 主轴高速 |
| CON\_50 | J13 |  |  |  |  |  |
| CON\_51 | K14 |  |  |  |  |  |
| CON\_52 | J14 |  | FPGA寄存器控制 | EXPND\_OU0 | OUT | 扩展控制输出（备用） |
| CON\_53 | J16 |  |  |  |  |  |
| CON\_54 | K15 |  |  |  |  |  |
| CON\_55 | K16 |  | FPGA寄存器控制 | RLY3 | OUT | 继电器控制信号 |
| CON\_56 | N14 |  | FPGA寄存器控制 | RLY2 | OUT | 继电器控制信号 |
| CON\_57 | N16 |  | FPGA寄存器控制 | RLY1 | OUT | 继电器控制信号 |
| CON\_58 | M15 |  | FPGA寄存器控制 | RLY0 | OUT | 继电器控制信号 |
| CON\_59 | M16 |  |  |  |  |  |
| CON\_60 | L14 |  |  |  |  |  |
| CON\_61 | L16 |  |  |  |  |  |
| CON\_62 | P15 |  | FPGA状态寄存器 | EXPND\_IN1 | IN | 扩展输入（备用） |
| CON\_63 | P16 |  |  |  |  |  |
| CON\_64 | R15 |  |  |  |  |  |
| CON\_65 | R16 |  |  |  |  |  |
| CON\_66 | R14 |  |  |  |  |  |
| CON\_67 | T15 |  | FPGA状态寄存器 | X\_ORG | IN | X原点行程开关输入 |
| CON\_68 | T14 |  | FPGA状态寄存器 | Y\_ORG | IN | Y原点行程开关输入 |
| CON\_69 | T13 |  | FPGA状态寄存器 | Z\_ORG | IN | Z原点行程开关输入 |
| CON\_70 | R12 |  | FPGA状态寄存器 | ESTOP | IN | 急停开关输入 |
| CON\_71 | T12 |  | FPGA状态寄存器 | ALIGN | IN | 对刀开关输入 |
| CON\_72 | L13 |  | FPGA状态寄存器 | PSTART | IN | 程序启开关输入 |
| CON\_73 | M13 |  | FPGA状态寄存器 | PSTOP | IN | 程序停开关输入 |
| 维宏卡连接器信号 | CON\_74 | M14 |  |  |  |  |  |
| CON\_75 | P11 |  |  | FF\_ZD | IN | 维宏卡主轴低速控制信号 |
| CON\_76 | N9 |  |  | FF\_ZF | IN | 维宏卡Z电机方向信号 |
| CON\_77 | P9 |  |  | FF\_YF | IN | 维宏卡Y电机方向信号 |
| CON\_78 | R9 |  |  | FF\_XF | IN | 维宏卡X电机方向信号 |
| CON\_79 | T9 |  |  | FF\_ZG | IN | 维宏卡主轴高速控制信号 |
| CON\_80 | N8 |  |  | FF\_XM | IN | 维宏卡X电机脉冲信号 |
| CON\_81 | T8 |  |  | FF\_YM | IN | 维宏卡Y电机脉冲信号 |
| CON\_82 | P7 |  |  | FF\_ZM | IN | 维宏卡Z电机脉冲信号 |
| CON\_83 | R7 |  |  |  |  |  |
| CON\_84 | T7 |  |  | FF\_ZZ | IN | 维宏卡主轴中速控制信号 |
| CON\_86 | P6 |  |  | FF\_DD | OUT | 维宏卡对刀信号 |
| CON\_87 | R5 |  |  | FF\_ZX | OUT | 维宏卡Z电机限位信号 |
| CON\_88 | P5 |  |  | FF\_YX | OUT | 维宏卡Y电机限位信号 |
| CON\_89 | P4 |  |  | FF\_XX | OUT | 维宏卡X电机限位信号 |
| CON\_90 | T4 |  |  |  |  |  |
| CON\_91 | N6 |  |  |  |  |  |

# 功能图

## WH模式

* 闪烁WH模式指示灯的红灯
* 电机控制信号直接接入FPGA。注意信号方向。

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| FF\_ZD | IN | 维宏卡主轴低速控制信号 | MA\_LOW | OUT | 主轴低速 |
| FF\_ZF | IN | 维宏卡Z电机方向信号 | Z1\_DIR | OUT | Z方向电机驱动方向 |
| FF\_YF | IN | 维宏卡Y电机方向信号 | Y1\_DIR | OUT | Y1方向电机驱动方向 |
| FF\_XF | IN | 维宏卡X电机方向信号 | X1\_DIR | OUT | X方向电机驱动方向 |
| FF\_ZG | IN | 维宏卡主轴高速控制信号 | MA\_HIGH | OUT | 主轴高速 |
| FF\_XM | IN | 维宏卡X电机脉冲信号 | X1\_PULS | OUT | X方向电机驱动脉冲 |
| FF\_YM | IN | 维宏卡Y电机脉冲信号 | Y1\_PULS | OUT | Y1方向电机驱动脉冲 |
| FF\_ZM | IN | 维宏卡Z电机脉冲信号 | Z1\_PULS | OUT | Z方向电机驱动脉冲 |
| FF\_ZZ | IN | 维宏卡主轴中速控制信号 | MA\_MIDU | OUT | 主轴中速 |
| FF\_DD | OUT | 维宏卡对刀信号 | ALIGN | IN | 对刀开关输入 |
| FF\_ZX | OUT | 维宏卡Z电机限位信号 | Z\_ORG | IN | Z原点行程开关输入 |
| FF\_YX | OUT | 维宏卡Y电机限位信号 | Y\_ORG | IN | Y原点行程开关输入 |
| FF\_XX | OUT | 维宏卡X电机限位信号 | X\_ORG | IN | X原点行程开关输入 |
| 缺省值 | | | Y2\_PULS | OUT | Y1方向电机驱动脉冲 |
| Y2\_DIR | OUT | Y1方向电机驱动方向 |
| EXPND\_OU0 | OUT | 扩展控制输出（备用） |
| RLY3 | OUT | 继电器控制信号 |
| RLY2 | OUT | 继电器控制信号 |
| RLY1 | OUT | 继电器控制信号 |
| RLY0 | OUT | 继电器控制信号 |
| EXPND\_IN1 | IN | 扩展输入（备用） |
| ESTOP | IN | 急停开关输入 |
| PSTART | IN | 程序启开关输入 |
| PSTOP | IN | 程序停开关输入 |

* 当检测到WH卡开始工作时，绿灯同时闪烁，网络记录WH卡发出的信号波形。

## SH模式

* 闪烁SH模式指示灯的红灯
* 电机控制信号由寄存器控制。寄存器由PC端设定。



* 网络控制电机
  + SH模式指示灯的绿灯同时闪烁
  + 电机控制寄存器（FPGA输出）：
  + 电机状态寄存器（FPGA输入）：

网络通过读取状态寄存器获取。WH卡的状态信号设置为Default值。

* WH卡控制电机
  + SH模式指示灯的蓝灯、黄灯同时闪烁。绿灯、红灯灭。
  + FPGA执行WH模式的工作。

# FPGA数据流

FPGA输入FIFO总线定义

|  |  |
| --- | --- |
| ***Bits*** | ***FPGA Name*** |
| 0 | FF\_ZD |
| 1 | FF\_ZF |
| 2 | FF\_YF |
| 3 | FF\_XF |
| 4 | FF\_ZG |
| 5 | FF\_XM |
| 6 | FF\_YM |
| 7 | FF\_ZM |
| 8 | FF\_ZZ |
| 9 | SW\_00 |
| 10 | SW\_01 |
| 11 | EXPND\_IN1 |
| 12 | X\_ORG |
| 13 | Y\_ORG |
| 14 | Z\_ORG |
| 15 | ESTOP |
| 16 | ALIGN |
| 17 | PSTART |
| 18 | PSTOP |
| 19 | SWITCH\_SET0 |
| 20 | SWITCH\_SET1 |
| 21 | SWITCH\_SET2 |
| 22 | SWITCH\_SET3 |

FPGA输出FIFO总线定义

|  |  |
| --- | --- |
| ***Bits*** | ***FPGA Name*** |
| 0 | X1\_PULS |
| 1 | X1\_DIR |
| 2 | Y1\_PULS |
| 3 | Y1\_DIR |
| 4 | Z1\_PULS |
| 5 | Z1\_DIR |
| 6 | Y2\_PULS |
| 7 | Y2\_DIR |
| 8 | MA\_LOW |
| 9 | MA\_MIDU |
| 10 | MA\_HIGH |
| 11 | EXPND\_OU0 |
| 12 | RLY3 |
| 13 | RLY2 |
| 14 | RLY1 |
| 15 | RLY0 |
| 16 | LED2\_RED |
| 17 | LED2\_GREEN |
| 18 | LED2\_BLUE |
| 19 | LED\_LIGHT0 |
| 20 | LED\_LIGHT1 |
| 21 | LED\_LIGHT2 |
| 22 | LED\_LIGHT3 |
| 23 | BUZZER\_EN |
| 24 | LED0 |
| 25 | LED1 |
| 26 | LED2 |
| 27 | LED3 |
| 28 | LED4 |
| 29 | LED5 |
| 30 | LED6 |
| 31 | LED7 |

# 串口设置与网络相机格式一致