

R7F0C80212ESP

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电压旋钮调节定时器 PWM 占空比

介绍

示例程序包括以下函数和功能:

- 微控制器的初始化
 - a. I/O端口初始化
 - b. 定时器输出PWM功能初始化
 - c. ADC功能初始化
 - d. 设置选项字节(Option Byte)
- 主应用循环
 - a. 启动定时器输出
 - b. 启动ADC, 检查转换完毕标志位, 重新开始转换
 - c. MCU中断启动

目标器件

RL78 / R7F0C80212ESP

当应用此示例程序于其他微控制器时, 请根据目标微控制器规格修改程序, 并对修改的程序充分进行评估。

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1. 执行示例程序

示例按以下顺序执行：

- (1) 打开工程“ PWM-AD.mtpj”；
- (2) 连接CS+内设GUI软件仿真；
- (3) 下载程序；
- (4) 重新执行(Restart)程序；
- (5) 用户可以在软件仿真视窗里的“I/O Panel1”，对电压旋钮进行操作, 作为电压输入；
- (6) 用户可以在软件仿真视窗里的“Timing Chart1”，观察TO00, TO01对应的I/O口状态.

- 软件仿真具有一定的局限性。用户程序发布前，请使用仿真器进行测试确认。
- 在使用仿真器仿真前，请先明确E1/EZ-CUBE硬件设置和与目标连接是否正确。
- 具体细节请参见E1/EZ-CUBE用户手册。并请检查E1/EZ-CUBE是否使用了最新固件。

2. 操作环境

工作频率	内部时钟
综合开发环境	瑞萨电子综合开发环境 CubeSuite+ V1.03.00
示例工程	PWM-AD.mtpj

3. 函数说明

此节描述示例程序中的各个函数。

[函数名称] IO_Init	
概要	I/O端口初始化
头文件	无
声明	void IO_init(void)
说明	
返回值	无
备注	无

[函数名称] TAU0_PWM_Init	
概要	定时器初始化
头文件	无
声明	void TAU0_PWM_init(void)
说明	设置P03为TO00输出, 200Hz 设置P04为TO01输出, 输出PWM 200Hz, 占空比为0%
返回值	无
备注	无

[函数名称] TAU0_Start	
概要	启动定时器
头文件	无
声明	void TAU0_Start(void)
说明	
返回值	无
备注	无

[函数名称] TAU0_Stop	
概要	停止定时器
头文件	无
声明	void TAU0_Stop(void)
说明	
返回值	无
备注	无

[函数名称] ADC_Init	
概要	ADC初始化
头文件	无
声明	void ADC_init(void)
说明	- 设置10-bit转换 - 设置转换ANIO电压

	- 使用ADC中断
返回值	无
备注	无

[函数名称] ADC_Start	
概要	启动ADC
头文件	无
声明	void ADC_Start(void)
说明	
返回值	无
备注	无

[函数名称] ADC_Stop	
概要	停止ADC
头文件	无
声明	void ADC_Stop(void)
说明	
返回值	无
备注	无

[函数名称] Main	
概要	主应用循环
头文件	无
声明	void main(void)
说明	- I/O端口, ADC, 定时器初始化 - ADC启动, 定时器启动, MCU中断允许 - 轮询标志位ad_flag (AD转换完毕) i) 如果ad_backup与ad_data值不相等, 把更新的ad_data值赋给ad_backup, 设置标志位duty_change (PWM占空比改变标志) ii) 清除标志位ad_flag, 重新开始转换
返回值	无
备注	无

[函数名称] interrupt_inttm00	
概要	定时器通道0中断服务程序
头文件	无
声明	void interrupt_inttm00 (void)
说明	- 检查标志位duty_change 把更新的ad_backup值赋给TDR01, 实现AD值对PWM占空比的调节
返回值	无
备注	无

[函数名称] interrupt_inttm01	
概要	定时器通道1中断服务程序
头文件	无
声明	void interrupt_inttm01 (void)
说明	
返回值	无
备注	无

[函数名称] interrupt_inttm01h	
概要	定时器通道1起始中断服务程序
头文件	无
声明	void interrupt_inttm01h (void)
说明	
返回值	无
备注	无

[函数名称] interrupt_intadc	
概要	ADC中断服务程序
头文件	无
声明	void interrupt_intadc (void)
说明	- 记录ADC值至变量ad_data - 设置标志位ad_flag
返回值	无
备注	无

[函数名称] interrupt_inttm01h	
概要	定时器通道1起始中断服务程序
头文件	无
声明	void interrupt_inttm01h (void)
说明	
返回值	无
备注	无

[函数名称] interrupt_intst0	
概要	SAU发送完毕中断服务程序
头文件	无
声明	void interrupt_intst0 (void)
说明	- 设置f_tx_end为发送完毕
返回值	无
备注	无

[函数名称] interrupt_intsr0	
概要	SAU接收完毕中断服务程序
头文件	无
声明	void interrupt_intsr0 (void)
说明	
返回值	无
备注	无

[函数名称] interrupt_intsre	
概要	SAU接收错误中断服务程序
头文件	无
声明	void interrupt_intsre (void)
说明	
返回值	无
备注	无

4. 设置选项字节 (Option Byte)

R7F0C80212ESP 闪存的00C0H、00C1H、00C2H 和00C3H 为选项字节区域。打开电源或从复位状态重启器件时，器件将自动参考选项字节设置指定功能。使用本产品时，必须使用选项字节设置下列功能。

选项字节以汇编码格式保全在“optionbyte.asm”汇编文档, 用户可按要求自行更改设置. 以下是本示例使用的设置.

OPT	CSEG	OPT_BYTE	
	DB	0E0H	; 看门狗定时器不操作 ; 看门狗定时器的溢出时间: 64/fIL, ; 禁止使用软件停止内部振荡电路不能通过软件。
	DB	0EBH	; P125/RESET脚为端口功能 ; 上电复位,上升电压值2.55V, 下降电压值2.50V
	DB	0FAH	; 内部高速振荡时钟频率 10 MHz
	DB	85H	; On-chip 调试允许操作。 On-chip 调试安全ID 认证失败 ; 时, 禁止清除闪存数据。

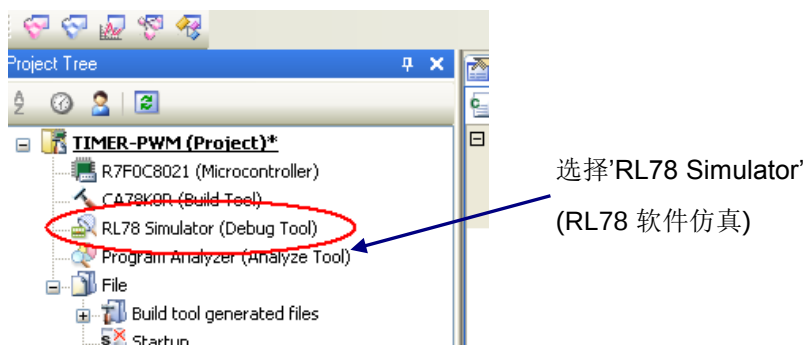
备注:

有关选项字节详情, 请参考微控制器的使用手册, 第十六章 选项字节

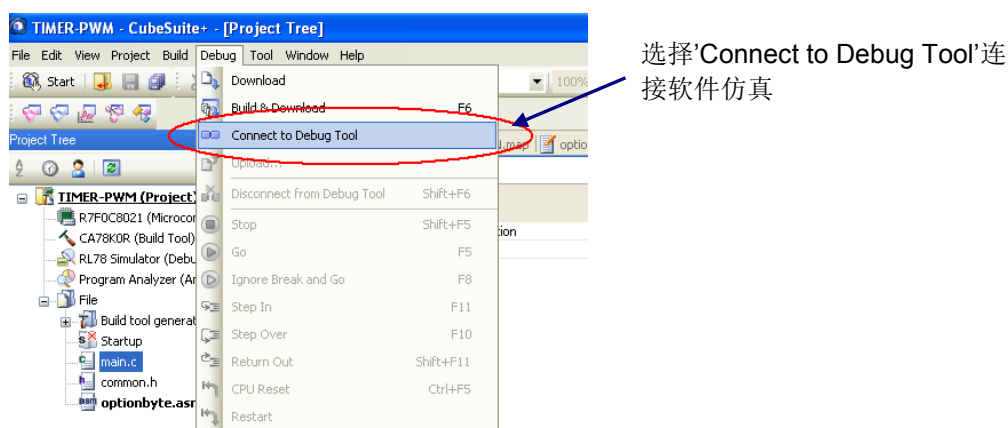
5. 使用 CS+ 内设 GUI 软件仿真器

5.1 启动 CS+ 内设 GUI 软件仿真:

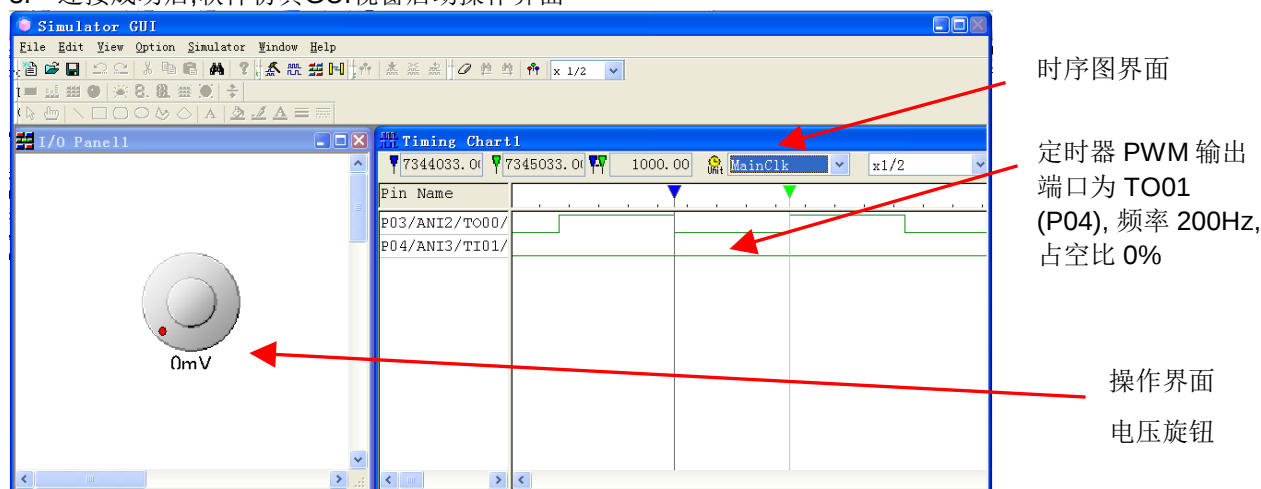
1. 打开工程后, 在'Project Tree'视窗里的(Debug Tool), 按鼠标右键, 选择'RL78 Simulator' (RL78 软件仿真).



2. 选择'Debug'内的选项'Connect to Debug Tool' RL78 软件仿真.



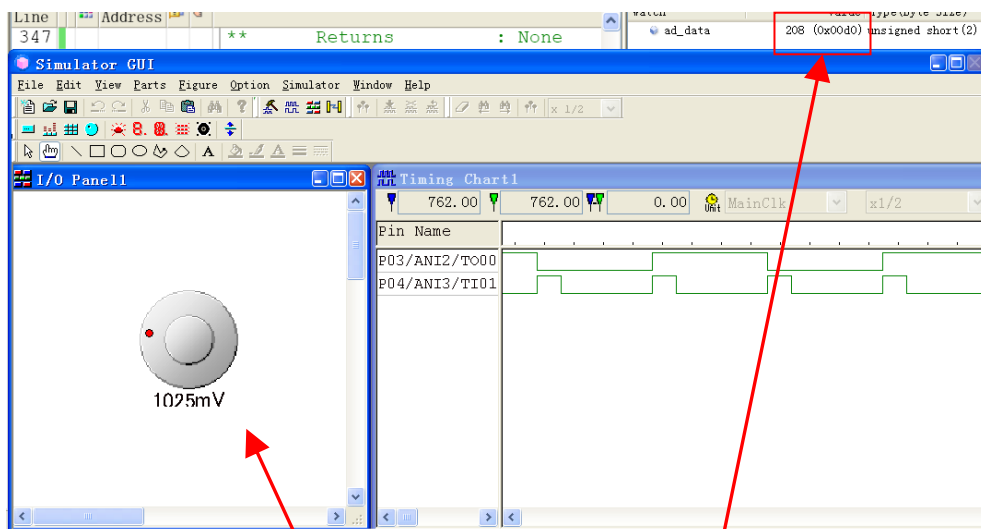
3. 连接成功后, 软件仿真GUI视窗启动操作界面



5.2 电压旋钮调节定时器 PWM 占空比示例程序操作:

1. 旋转电压旋钮调节PWM的占空比.

* 占空因数[%] = $TDR01 / (TDR00 + 1) \times 100$

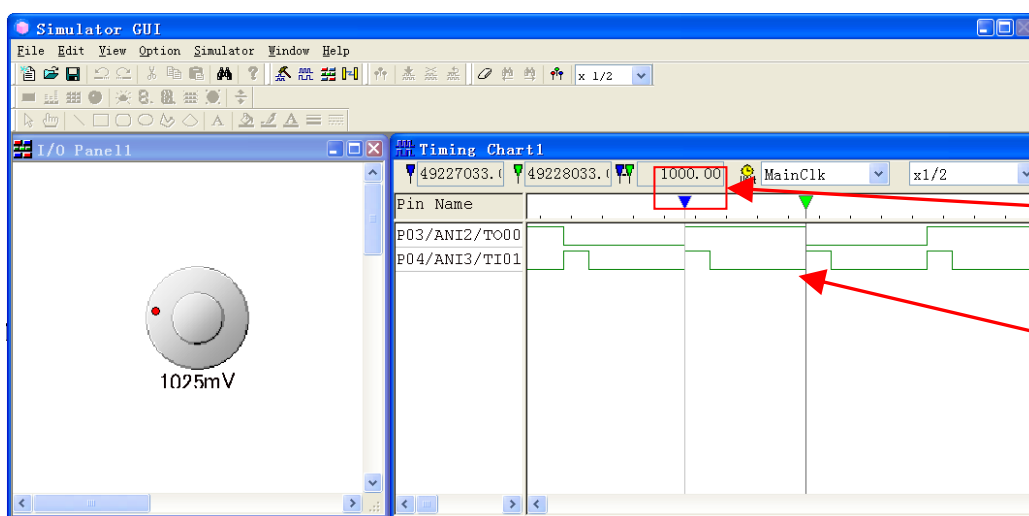


在操作界面上, 旋转电压旋钮改变电压, 在 Watch 视窗检查 ad_data 值.

电压值 = $ad_data \times (5V / 1024)$

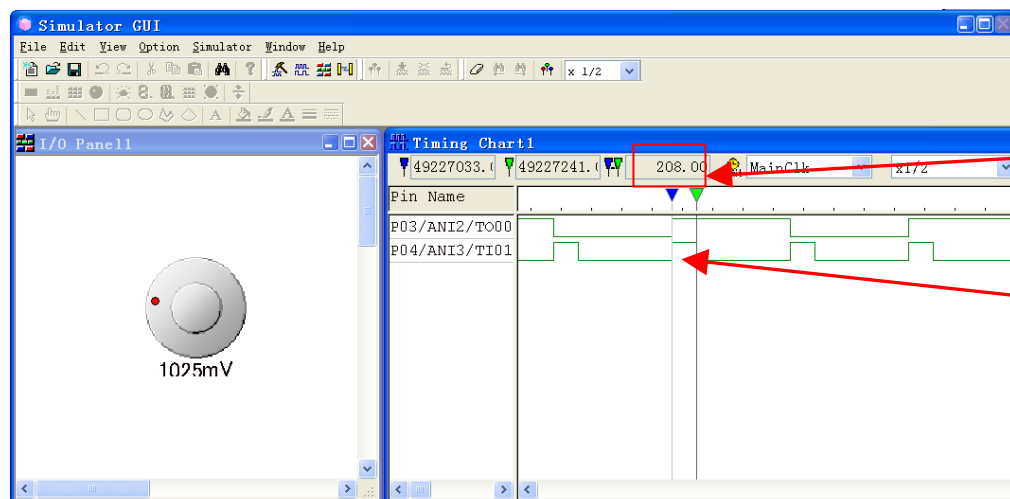
例:

$208 \times (5V / 1024) = \underline{1016mV}$



$(TDR00 + 1) = 1000$

在时序图界面,
TO01(P04)输出 PWM
频率为 200Hz.

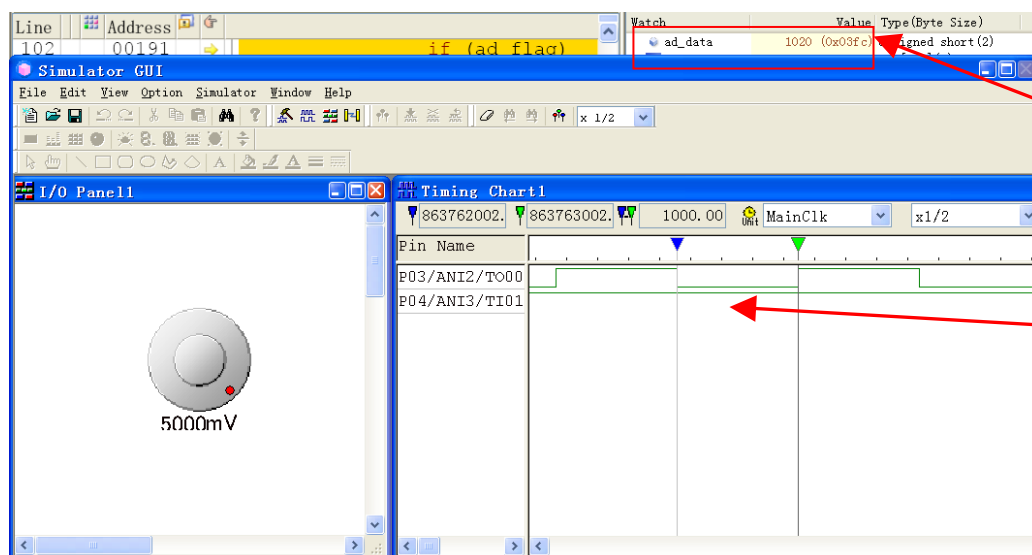


TDR01 = 208

在时序图界面,
TO01(P04)输出
PWM 占空比为
20.8%.

2. 旋转电压旋钮输出占空比为100%的PWM

*占空比100%: $TDR01 \geq TDR00 + 1$



TDR01 = 1020
(TDR00+1) = 1000

在时序图界面,
TO01(P04)输出
PWM 占空比为
100%.

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		页	概要
1.00	Nov 1, 2012	—	第一版发行

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本文对适用于单片机所有产品的“使用时的注意事项”进行说明。有关个别的使用时的注意事项请参照正文。此外，如果在记载上有与本手册的正文有差异之处，请以正文为准。

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【注意】将未使用的引脚按照正文的“未使用引脚的处理”进行处理。

CMOS产品的输入引脚的阻抗一般为高阻抗。如果在开路的状态下运行未使用的引脚，由于感应现象，外加LSI周围的噪声，在LSI内部产生穿透电流，有可能被误认为是输入信号而引起误动作。

未使用的引脚，请按照正文的“未使用引脚的处理”中的指示进行处理。

2. 通电时的处理

【注意】通电时产品处于不定状态。

通电时，LSI内部电路处于不确定状态，寄存器的设定和各引脚的状态不定。通过外部复位引脚对产品进行复位时，从通电到复位有效之前的期间，不能保证引脚的状态。

同样，使用内部上电复位功能对产品进行复位时，从通电到达到复位产生的一定电压的期间，不能保证引脚的状态。

3. 禁止存取保留地址（保留区）

【注意】禁止存取保留地址（保留区）

在地址区域中，有被分配将来用作功能扩展的保留地址（保留区）。因为无法保证存取这些地址时的运行，所以不能对保留地址（保留区）进行存取。

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在程序运行中切换时钟时，请在要切换成的时钟稳定之后进行。复位时，在通过使用外部振荡器（或者外部振荡电路）的时钟开始运行的系统中，必须在时钟充分稳定后解除复位。另外，在程序运行中，切换成使用外部振荡器（或者外部振荡电路）的时钟时，在要切换成的时钟充分稳定后再进行切换。

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