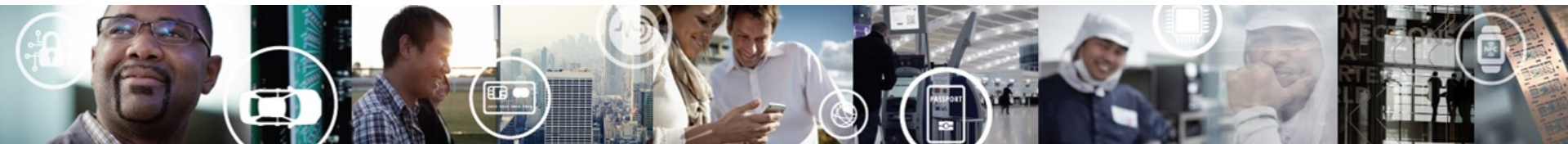


LPC82X 培训资料

模数转换器ADC

MAY, 2016



EXTERNAL USE



SECURE CONNECTIONS
FOR A SMARTER WORLD

内容

- ADC特征及电气特性
- ADC功能模块及配置

ADC特征及电气特性

ADC特征

- 12位逐次比较型模数转换器
- 转换速率高达1.2Msample/s
- 两个独立触发可配置的转换序列
- 自动采样结果“过零”比较检测
- 具有power-down模式和low-power操作模式
- 支持单/多通道突发(burst)转换模式
- 支持DMA功能
- 支持硬件校准模式
- 电压的测量范围为 $V_{REFN} \sim V_{REFP}$
- 不同封装的的ADC通道数不一样

Package	ADC channels available
TSSOP20	ADC_2, ADC_3, ADC_9, ADC_10, ADC_11
HVQFN33	ADC_0 to ADC_11

ADC电气特性-1

- ADC在正常工作状态下，主频是12MHz和30MHz的时候，典型的电流分别是1990uA和2070uA。

Peripheral	Typical supply current in uA			Notes
	Main clock frequency =			
	n/a	12MHZ	30MHZ	
ADC	-	57	141	Digital controller only. Analog portion of the ADC disabled in the PDRUNCFG register.
	-	57	141	Combined analog and digital logic, ADC enabled in the PDRUNCFG register and LPWRMODE bit set to 1 in the ADC CTRL register (ADC in low-power mode).
	-	1990	2070	Combined analog and digital logic. ADC enabled in the PDRUNCFG register and LPWRMODE bit set to 0 in the ADC CTRL register (ADC powered).

ADC电气特性-2

- 有关ADC的输入电压、参考电压、时钟频率、采样时钟等静态特性请参考下表。

- $T_{amb} = -40^{\circ}\text{C}$ to $+105^{\circ}\text{C}$ unless noted otherwise; $V_{DD} = 2.4\text{V}$ to 3.6V ; $V_{REFP} = V_{DD}$; $V_{REFN} = V_{SS}$.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IA}	Analog input voltage		0	-	V_{DD}	V
V_{ref}	Reference voltage	On pin VREFP	2.4	-	V_{DD}	V
C_{ia}	Analog input capacitance		-	-	0.32	pF
$F_{clk(ADC)}$	ADC clock frequency	$2.7\text{V} \leq V_{DD} \leq 3.6\text{V}$	-	-	30	MHz
		$2.4\text{V} \leq V_{DD} \leq 2.7\text{V}$	-	-	25	MHz
F_s	Sampling frequency	$2.7\text{V} \leq V_{DD} \leq 3.6\text{V}$	-	-	1.2	Msamples/s
		$2.4\text{V} \leq V_{DD} \leq 2.7\text{V}$	-	-	1	Msamples/s
E_D	Differential linearity error	$T_{amb} = 105^{\circ}\text{C}$	-	+/-2.5	-	LSB
$E_{L(ad)}$	Integral non-linearity	$T_{amb} = 105^{\circ}\text{C}$	-	+/-2.5	-	LSB
E_O	Offset error	$T_{amb} = 105^{\circ}\text{C}$	-	+/-4.5	-	LSB
$V_{err(fs)}$	Full-scale error voltage	1.2Msamples/s; $T_{amb} = 105^{\circ}\text{C}$	-	+/-0.5	-	%
Z_i	Input impedance	$F_s = 1.2\text{Msamples/s}$	0.1	-	-	$\text{M}\Omega$

ADC功能模块及配置

ADC引脚配置-1

- ADC参考电源引脚

- 参考电源的供电要求 $(V_{REFP} - V_{REFN}) / 2 + V_{REFN} = V_{DD}/2$ ，为了达到最好的效果， V_{REFP} 和 V_{REFN} 与 V_{DD} 和 V_{SS} 的电压相同

- ADC外设不使用的情况下， V_{REFP} 连接到 V_{DD} ， V_{REFN} 连接到 V_{SS}

Function	Description
V_{REFP}	Positive voltage reference. The VREFP voltage level must be between 2.4V and V_{DDA} . For best performance, select $V_{REFP}=V_{DDA}$ and $V_{REFN}=V_{SSA}$.
V_{REFN}	Negative voltage reference.
$V_{DDA} = V_{DD}$	The analog supply voltage is internally connected to V_{DD} .
$V_{SSA} = V_{SS}$	ADC ground is internally connected to V_{SS} .

ADC引脚配置-2

- ADC采样引脚

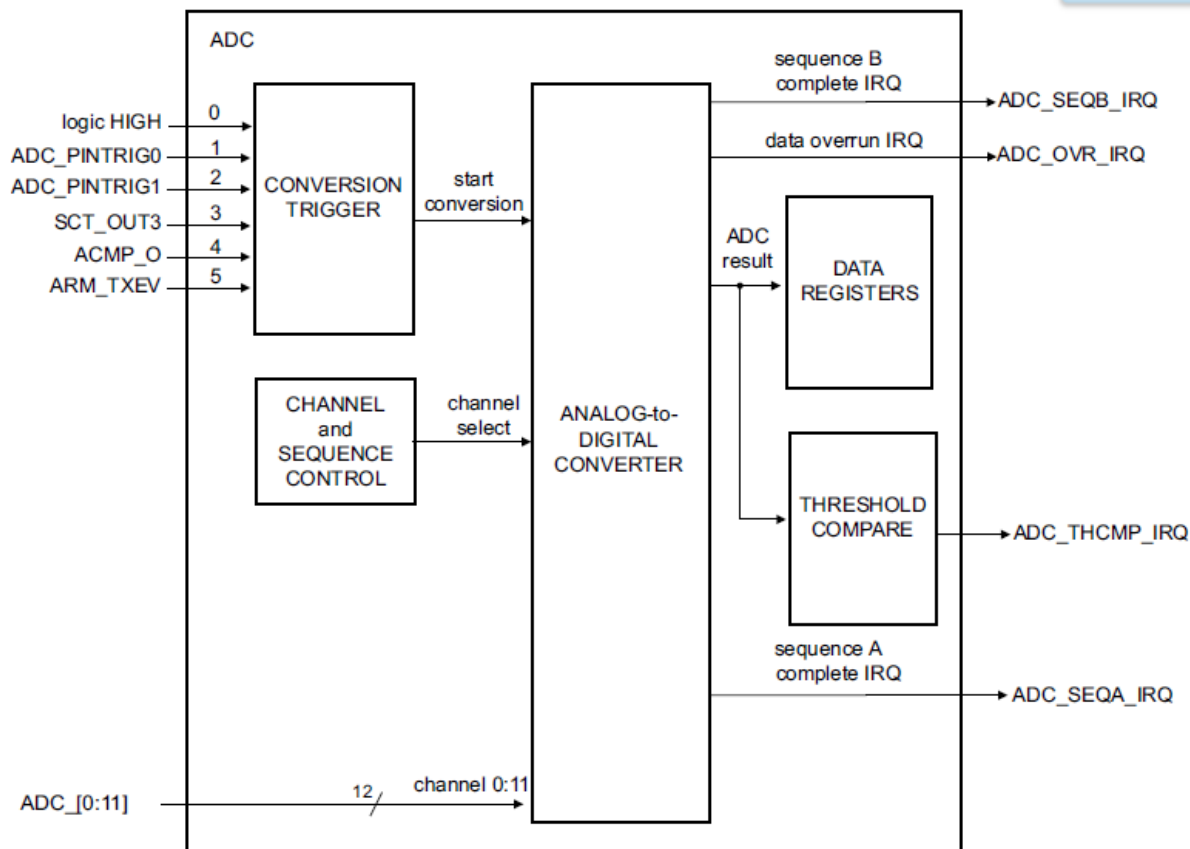
- 确保测量信号的电压应低于 V_{DD}

- IOCON寄存器配置ADC采样引脚，应禁用内部上拉和下拉电阻

Function	Direction	Type	Connect to	Use register	Description
ADC_0	AI	external to pin	PIO0_7	PINENABLE0	Analog input channel 0.
ADC_1	AI	external to pin	PIO0_6	PINENABLE0	Analog input channel 1.
ADC_2	AI	external to pin	PIO0_14	PINENABLE0	Analog input channel 2.
ADC_3	AI	external to pin	PIO0_23	PINENABLE0	Analog input channel 3.
ADC_4	AI	external to pin	PIO0_22	PINENABLE0	Analog input channel 4.
ADC_5	AI	external to pin	PIO0_21	PINENABLE0	Analog input channel 5.
ADC_6	AI	external to pin	PIO0_20	PINENABLE0	Analog input channel 6.
ADC_7	AI	external to pin	PIO0_19	PINENABLE0	Analog input channel 7.
ADC_8	AI	external to pin	PIO0_18	PINENABLE0	Analog input channel 8.
ADC_9	AI	external to pin	PIO0_17	PINENABLE0	Analog input channel 9.
ADC_10	AI	external to pin	PIO0_13	PINENABLE0	Analog input channel 10.
ADC_11	AI	external to pin	PIO0_4	PINENABLE0	Analog input channel 11.
ADC_PINTRIG0	I	external to pin	Any GPIO	PINASSIGN10	ADC pin trigger 0.
ADC_PINTRIG1	I	external to pin	Any GPIO	PINASSIGN11	ADC pin trigger 1.

ADC功能模块

- ADC全精度的采样转换需要25个ADC clock
- ADC的时钟来源于系统时钟，最大ADC的时钟频率为30MHz



ADC寄存器描述

- ADC的寄存器可以分为四类：
 - 全局控制及数据寄存器：CTRL、SEQA_CTRL、SEQB_CTRL、SEQA_GDAT、TRIM和SEQB_GDAT
 - 数据寄存器：DAT0 ~ DAT11
 - 采样结果进行比较相关的寄存器：THR0_LOW、THR1_LOW、THR0_HIGH和THR1_HIGH
 - 中断相关的寄存器：INTEN、FLAGS

ADC基本配置

第一步

- 使能ADC外设电源
 - `Chip_SYSCTL_PowerUp(SYSCTL_SLPWAKE_ADC_PD);`

第二步

- 使能ADC外设时钟
 - `Chip_Clock_EnablePeriphClock(SYSCTL_CLOCK_ADC);`

第三步

- 使能ADC外设的中断，共4个（可选）
 - `NVIC_EnableIRQ(ADC_SEQA_IRQn);` `NVIC_EnableIRQ(ADC_SEQB_IRQn);`
 - `NVIC_EnableIRQ(ADC_THCMP_IRQn);` `NVIC_EnableIRQ(ADC_OVR_IRQn);`

第四步

- 使能ADC外设输入引脚

第五步

- 每次上电或者Deep power-down模式下唤醒，都需要校准ADC
 - `Chip_ADC_StartCalibration(LPC_ADC);`
 - `while (!(Chip_ADC_IsCalibrationDone(LPC_ADC))) {}`

第六步

- 设置ADC的采样率（可选）
 - `Chip_ADC_SetClockRate(LPC_ADC, ADC_MAX_SAMPLE_RATE);`



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