AD-APARD32690-SL

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Quick Links

- MAX32690 datasheet: https://www.analog.com/media/en/technical-documentation/data-sheets/max32690.pdf
- AD-APARD32690-SL User Guide: AD-APARD32690-SL User Guide [Analog Devices Wiki]
- AD-APARD32690 schematic: 02-073637-01-c.pdf
- 32690 MSDK Peripheral Driver API: MAX32690 Peripheral Driver API: Main Page

Pins

USER LEDs

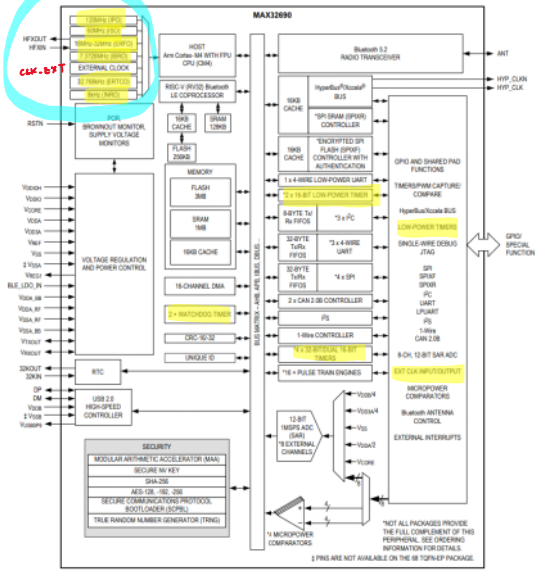
- schematic: 02-073637-01-c.pdf
- LED1
  - index 0
  - P2.1
  - DS2
- LED2
  - index 1
  - P0.11
  - D5
- LED3
  - index 2
  - P0.12
  - D5

Processors

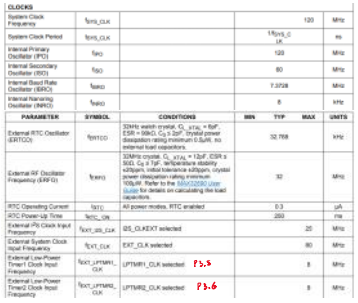
- Cortex-M4 (CM4)
  - 12 MHz
  - general purpose
  - with FPU
- RISC-V (RV32)
  - 32-bit
  - coprocessor
  - ultra-low-power
  - offload data processing

clocking scheme diagram

Simplified Block Diagram MAX32690



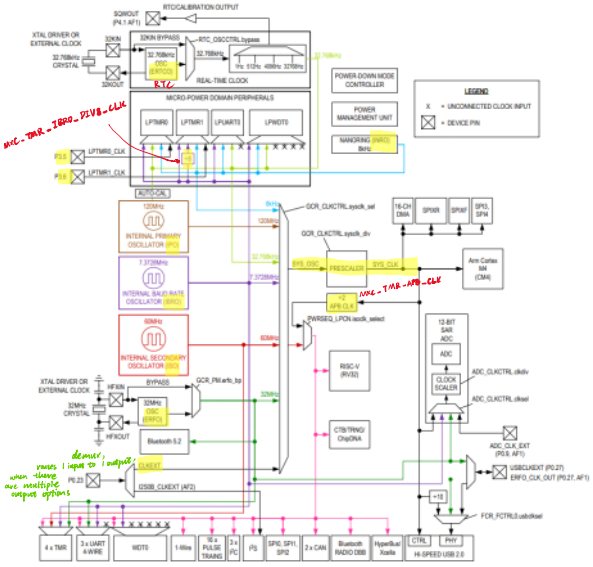
Electrical Characteristics MAX32690



CLOCKS					
System Clock Frequency	f_{SYS_CLK}			120	MHz
System Clock Period	t_{SYS_CLK}			1/f_{SYS_CLK}	ns
Internal Primary Oscillator (IPO)	f_{IPO}			120	MHz
Internal Secondary Oscillator (ISO)	f_{ISO}			60	MHz
Internal Baud Rate Oscillator (IBRO)	f_{IBRO}			7.3728	MHz
Internal Nanoring Oscillator (INRO)	f_{INRO}			8	kHz

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
External RTC Oscillator (ERTCO)	f_{ERTCO}	32kHz watch crystal, C_L = 6pF, ESR = 90kΩ, C_S ≤ 2pF, crystal power dissipation rating minimum 0.5µW, no external load capacitors		32.768		kHz
External RF Oscillator Frequency (ERFO)	f_{ERFO}	32MHz crystal, C_L = 12pF, ESR ≤ 30Ω, C_S ≤ 7pF, temperature stability ±20ppm, initial tolerance ±20ppm, crystal power dissipation rating minimum 100µW. Refer to the MAX32690 User Guide for details on calculating the load capacitors.		32		MHz
RTC Operating Current	I_{RTC}	All power modes, RTC enabled		0.3		µA
RTC Power-up Time	t_{RTC_ON}			250		ms
External I²S Clock Input Frequency	$f_{EXT\_I2S\_CLK}$	I2S_CLKEXT selected			25	MHz
External System Clock Input Frequency	f_{EXT_CLK}	EXT_CLK selected			80	MHz
External Low-Power Timer0 Clock Input Frequency	$f_{EXT\_LPTMR0\_CLK}$	LPTMR0_CLK selected: P0.5			8	MHz
External Low-Power Timer2 Clock Input Frequency	$f_{EXT\_LPTMR2\_CLK}$	LPTMR2_CLK selected: P3.6			8	MHz

Clocking Scheme Diagram MAX32690



Timers and Clocks

- MAX32690
- Diagrams
  - Simplified Block Diagram
  - Electrical Characteristics
  - Clocking Scheme Diagram
- **SYS_CLK** is system clock
- **SYS_TICK** is system timer
  - clock vs. timer

Clock Source

- Pick one of the following 7 as **SYS_CLK** (system clock)
  - **IPO**
    - Internal Primary Oscillator
    - 120MHz
  - **ISO**
    - Internal Secondary Oscillator
    - 60 MHz
    - used for exiting power-on reset
  - **IBRO**
    - Internal Baud Rate Oscillator
    - 7.3728 MHz
    - optimize active power consumption
    - allow UART communications to meet 2% baud rate tolerance
  - **INRO**
    - Internal Nanoring Oscillator
    - 8 kHz
    - ultra low power
  - **ERFO**
    - External RF Oscillator
      - external crystal required
    - 32 MHz
  - **ERTCO**
    - 32.768 kHz
    - External RTC Oscillator
      - RTC: Real-Time Clock
      - external crystal required
    - Y3 in schematic
  - **CLKEXT**
    - external clock (P0.23)
      - does not have exposed connector for probing on APARD
      - another name: ADIN1110_LINK_ST
- **SYS_CLK** is primary clock source for digital logic and peripherals
- Wakeup
  - IBRO or IPO
- Exit Power-on reset
  - ISO
- Clock Source in MSDK

```
MXC_TMR_APB_CLK = 0, // PCLK, peripheral clock, SYS_CLK/2
MXC_TMR_EXT_CLK = 1, // external clock from P0.23
MXC_TMR_ISO_CLK = 2, // internal secondary oscillator, 60 MHz
MXC_TMR_IBRO_CLK = 3, // Internal baud rate oscillator, 7.3728 MHz
MXC_TMR_ERFO_CLK = 4, // external RF oscillator, 32 MHz
MXC_TMR_ERTCO_CLK = 5, // external RTC oscillator, 32.768 kHz
MXC_TMR_INRO_CLK = 6, // internal nanoring oscillator, 8 kHz
MXC_TMR_IBRO_DIV8_CLK = 7, //(7.3728/8) = 0.9216 MHz
```

  - Why no IPO when IPO is part of the mux in Clocking Scheme Diagram?
  - External Low-power Timer (LPTMR0,1)

RTC (Real-Time Clock)

- datasheet: MAX32690
- 32-bit seconds register
  - 2^32 seconds ~= 136 years
- provide 2 time-of-day alarms
  - 1st alarm
    - alarm from 1 second to 12 days
    - can be used as a power-saving timer for low-power mode
  - 2nd alarm
    - 32-bit 1/4096 sub-second alarm
    - tick resolution of 244us
- clock source
  - 32.768 kHz crystal
  - or external clock
- calibration
  - user software can compensate for minor variations in RTC
  - enable SQWOUT alternate function to output RTC timing signal
  - adjust RTC frequency through external hardware

32-bit Timer Instances MAX32690

Table 4. MAX32690 Timer Instances

INSTANCE	REGISTER ACCESS NAME	SINGLE 32-BIT	DUAL 16-BIT	SINGLE 16-BIT	POWER MODE	CLOCK SOURCE						
						PCLK	ISO	IBRO	INRO	ERTCO	LPTMR0_ CLK	LPTMR1_ CLK
TMR0	TMR0	Yes	Yes	No	ACTIVE, SLEEP, LPM	Yes	Yes	Yes	No	Yes	No	No
TMR1	TMR1	Yes	Yes	No	ACTIVE, SLEEP, LPM	Yes	Yes	Yes	No	Yes	No	No
TMR2	TMR2	Yes	Yes	No	ACTIVE, SLEEP, LPM	Yes	Yes	Yes	No	Yes	No	No
TMR3	TMR3	Yes	Yes	No	ACTIVE, SLEEP, LPM	Yes	Yes	Yes	No	Yes	No	No
LPTMR0	TMR4	No	No	Yes	ACTIVE, SLEEP, LPM, UPM	No	No	Yes	Yes	Yes	Yes	No
LPTMR1*	TMR5	No	No	Yes	ACTIVE, SLEEP, LPM, UPM	No	No	Yes	Yes	Yes	No	Yes

*Available as an internal timer only on the 68-pin TQFN-EP package. There is no external connection to this timer on the 68-pin TQFN-EP package.

WDT Timer Instances MAX32690

Programmable Timers

32-Bit Timer / Counter / PWM (TMR, LPTMR)

- general purpose
- 32-bit timers

- [illegible]
  - adjust RTC frequency through external hardware

Programmable Timers

32-Bit Timer / Counter / PWM (TMR, LPTMR)

- general purpose
- 32-bit timers
- for timing, capture/compare, PWM generation
  - timer modes
- features
  - 32-bit up/down auto reload
  - programmable prescaler
  - PWM
  - capture & compare
  - timer input, clock gating, capture
  - timer output
  - dual 16-bit timer
  - interrupts
- six 32-bit timers
  - operate in SLEEP, LPM, UPM modes
    - Modes
- 32-bit Timer Instances

Watchdong Timer (WDT)

- compensate for electrical noise and EMI
- detects system unresponsiveness
- 32-bit, free-running counter
  - configurable prescaler
- must be periodically reset
- WDT timeout can trigger interrupt and system reset
  - force the instruction pointer to a known good location
- WDT timer instances

Pulse Train Engine (PT)

- periodic signals
- can read more from datasheet MAX32690

Wakeup Timer

- ERTCO as clock source
- prescaler from 1 to 4096
- support one-shot and continuous
- independent interrupt handler

LPTMR1*	TMR5	No	No	Yes	ACTIVE, SLEEP, LPM, UPM	No	No	Yes	Yes	Yes	No	Yes

*Available as an internal timer only on the 68-pin TQFN-EP package. There is no external connection to this timer on the 68-pin TQFN-EP package.

WDT Timer Instances MAX32690

Table 5. MAX32690 Watchdog Timer Instances

INSTANCE NAME	REGISTER ACCESS NAME	POWER MODE	CLOCK SOURCE			
			PCLK	IBRO	INRO	ERTCO
WDT0	WDT0	ACTIVE, SLEEP, LPM	Yes	Yes	No	No
LPWDT0	WDT1	ACTIVE, SLEEP, LPM, UPM	No	Yes	Yes	Yes

Power Management

- user-configurable system clock

Modes

ACTIVE Mode

- both CM4 and RV32 can execute software
  - CM4: all system SRAM
  - RV32: 256KB flash and 128KB SRAM8
  - can execute from internal flash simultaneously
- all peripherals are on
- dynamic clocking disable peripherals not in use
- high performance while low-power consumption

SLEEP Mode

- less power than ACTIVE mode
- wakes faster then LPM mode
- clocks can optionally be enabled
- CM4 & RV32 are asleep
- peripherals are on
- clocks
  - all oscillators are available

LOW POWER Mode (LPM)

- CM4, SRAM0 - SRAM7 are in state retention
- RV32 can access several peripherals
- clocks
  - IPO can optionally be powered down
  - INRO is on
  - IBRO, ERTCO, ISO and ERFO are optionally enabled

MICRO POWER Mode (UPM)

- CM4 & RV32 are state retained
- all non-MICRO Power domain peripherals are state retained
- clocks
  - IPO, ISO, ERFO are powered down
  - INRO is on
  - IBRO, ERTCO are optionally enabled

STANDBY Mode

- maintain system operation while keeping RTC
- CM4 & RV32 are state retained
- clocks
  - RTC, wakeup timers, ERTCO optionally enabled
  - INRO is on

BACKUP Mode

- CM4 & RV32 are powered off
- all peripherals are powered down
- clocks
  - ERTCO, RTC, wakeup timers are optionally enabled
  - INRO is on
  - IPO, ISO, IBRO, ERFO are powered down