FACULTAD DE INGENIERIA
Universidad de Buenos Aires

Especialización de Sistemas Embebidos

Trabajo Práctico Final - Protocolos de comunicación en SE

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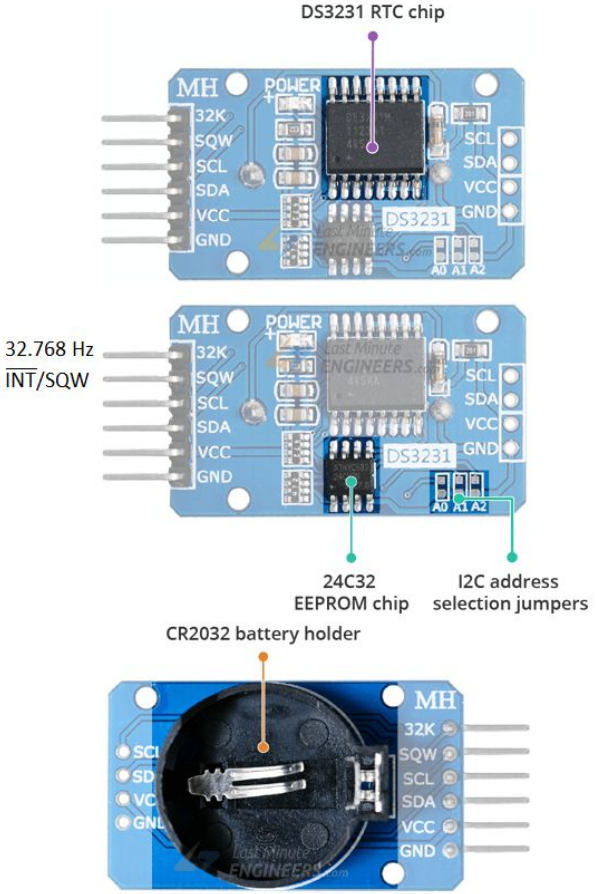
Objetivos del TP

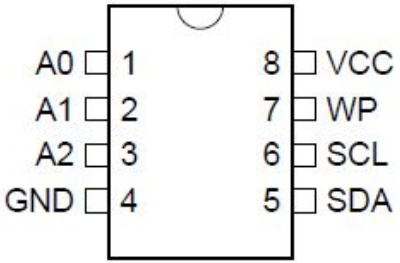
- Implementar librería para manejo de módulo RTC + sensor de T° + EEPROM.
- Direccionamiento I^2C.
- Código ejemplo para escribir y leer hora en el RTC, leer temperatura por protocolo y guardar en EEPROM.
- Uso de sapi_i2c.h: I2C0 @ 100kHz

Hardware

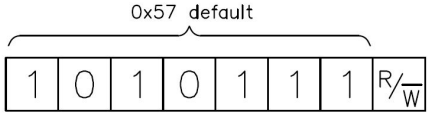
- Alimentación 3.3 V
- Bus SCL + SDA enlazables.
- 8 direcciones I2C EEPROM ajustables (default 0x57)
- Dirección I^2C RTC fija (0x68).
- Batería 3V CR2032
- Salidas programables:
  - Oscilador 32.768 Hz.
  - INT/SQW: señal cuadrada con DC ajustable o Pin digital.



Hardware: EEPROM 24C32

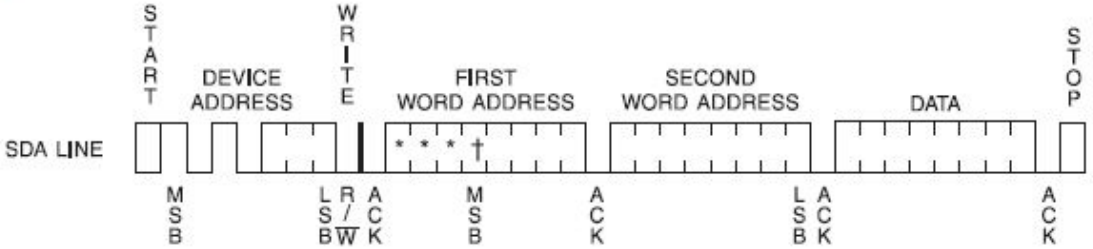


- Tamaño 32K (4096 x 8) bits.
- 128 páginas de 32 bytes.
- 8 bit device address: header (0b1010) + I^2C address (0b111) + R/W.

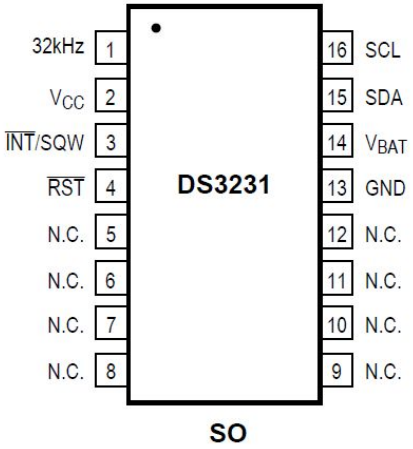


- 12 bit word address: direcciones desde 0x000 hasta 0xFFF.

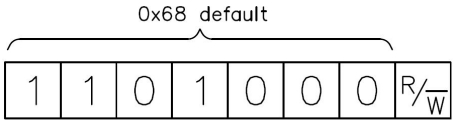
Byte Write



Hardware: RTC DS3231



- I²C slave address: Header (0b1101) + I2C address (0b000) + R/W



- Registros horarios en BCD:

ADDRESS	BIT 7 MSB	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0 LSB	FUNCTION	RANGE
00h	0	10 Seconds			Seconds				Seconds	00–59
01h	0	10 Minutes			Minutes				Minutes	00–59
02h	0	12/$\overline{24}$	$\overline{AM}$/PM 20 Hour	10 Hour	Hour				Hours	1–12 + $\overline{AM}$/PM 00–23

- Compensación por temperatura y envejecimiento.
- 2 alarmas configurables (1/sec, 1/min, 1/hora, 1/dia, 1/semana, 1/mes, 1/año)
- Registro de temperatura accesible por I²C: 10 bits signados. Resolución 0.25°C
- Map address: 19 registros (0x00 a 0x12) de 8 bits.

Hardware: RTC DS3231

- Lectura / Escritura:

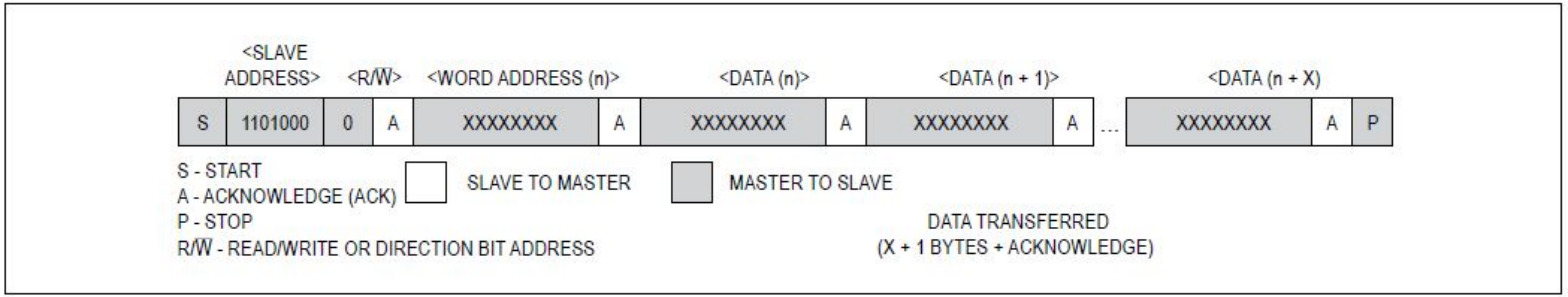


Figure 3. Data Write—Slave Receiver Mode

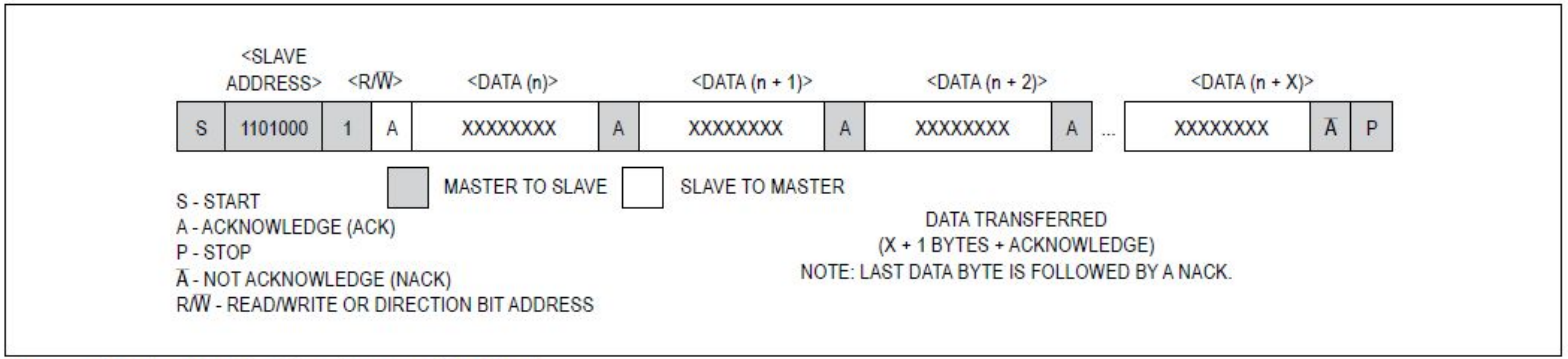


Figure 4. Data Read—Slave Transmitter Mode

RTC DS3231: Mapa de memoria

ADDRESS	BIT 7 MSB	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0 LSB	FUNCTION	RANGE
00h	0	10 Seconds			Seconds				Seconds	00–59
01h	0	10 Minutes			Minutes				Minutes	00–59
02h	0	12/$\overline{24}$	$\overline{AM}$/PM 20 Hour	10 Hour	Hour				Hours	1–12 + $\overline{AM}$/PM 00–23
03h	0	0	0	0	0	Day			Day	1–7
04h	0	0	10 Date		Date				Date	01–31
05h	Century	0	0	10 Month	Month				Month/ Century	01–12 + Century
06h	10 Year				Year				Year	00–99
07h	A1M1	10 Seconds			Seconds				Alarm 1 Seconds	00–59
08h	A1M2	10 Minutes			Minutes				Alarm 1 Minutes	00–59
09h	A1M3	12/$\overline{24}$	$\overline{AM}$/PM 20 Hour	10 Hour	Hour				Alarm 1 Hours	1–12 + $\overline{AM}$/PM 00–23
0Ah	A1M4	DY/$\overline{DT}$	10 Date		Day				Alarm 1 Day	1–7
					Date				Alarm 1 Date	1–31
0Bh	A2M2	10 Minutes			Minutes				Alarm 2 Minutes	00–59
0Ch	A2M3	12/$\overline{24}$	$\overline{AM}$/PM 20 Hour	10 Hour	Hour				Alarm 2 Hours	1–12 + $\overline{AM}$/PM 00–23
0Dh	A2M4	DY/$\overline{DT}$	10 Date		Day				Alarm 2 Day	1–7
					Date				Alarm 2 Date	1–31
0Eh	$\overline{EOSC}$	BBSQW	CONV	RS2	RS1	INTCN	A2IE	A1IE	Control	—
0Fh	OSF	0	0	0	EN32kHz	BSY	A2F	A1F	Control/Status	—
10h	SIGN	DATA	DATA	DATA	DATA	DATA	DATA	DATA	Aging Offset	—
11h	SIGN	DATA	DATA	DATA	DATA	DATA	DATA	DATA	MSB of Temp	—
12h	DATA	DATA	0	0	0	0	0	0	LSB of Temp	—

Preguntas?

Gracias!