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APPLICATION NOTE 701

Using the DS32kHz with Dallas Real-Time Clocks

Abstract: This application note describes how to reduce current consumption when using the DS32kHz with Dallas Real-Time Clocks (RTCs).

Overview

This application note is intended to answer some frequently asked questions about using the DS32kHz TCXO (temperature-compensated crystal oscillator) and Dallas Semiconductor real-time clocks (RTCs).

Using the DS32kHz

The DS32kHz has four pins that are required for operation: V_{CC}, V_{BAT}, GND, and 32kHz_OUT. The V_{CC}, V_{BAT}, and GND are power supply connections and must either be connected to a positive supply or grounded. The 32kHz_OUT signal is intended to drive the X1 input of the RTC. The X2 pin of the RTC should be allowed to float when driving the X1 input with an oscillator.

The DS32kHz I_{CC} and I_{BAT} specifications are measured with no output load. The input characteristics of the oscillator on a RTC will determine how much additional current the DS32kHz will consume. The additional current can significantly increase the size of the battery needed for operation.

Choosing an RTC

Dallas Semiconductor has a wide selection of RTCs from which to choose. Some of these devices were designed using a P-WELL process while the more recent devices have been designed using the first-generation N-WELL process. The second-generation N-WELL RTCs incorporate improvements that reduce the current consumption of the TCXO/RTC combination. The following data shows the current consumed by typical devices from each process. The data were taken at a battery voltage of 3.5V at +25°C.

KEY:
Ind = Individual Currents; DS32kHz with output open, RTC with crystal attached and running.
Direct = DS32kHz driving the RTC X1 input directly.
RC = DS32kHz driving the RTC with a 1MΩ resistor in series with a 100pF capacitor to the X1 input.

Table 1. N-WELL (First Generation)

Mode	DS32kHz I_{BAT} (µA)	DS1306 I_{BAT} (nA)
Ind	1.60	518
Direct	11.9	386
RC	2.14	584

Table 2. N-WELL (Second Generation)

Mode	DS32kHz IBAT (µA)	DS1337 I_{CC} (nA)
Ind	1.59	612
Direct	3.73	626
RC	2.11	622

Table 3. P-WELL

Mode	DS32kHz I_{BAT} (µA)	DS1202 I_{BAT} (nA)
Ind	1.63	625
Direct	87.1	3,410
RC	2.17	685

Note the RTC in each of the aforementioned tables are different RTCs. This accounts for the difference in the clock currents when comparing the tables.

If the RTC has an oscillator-enable bit, the oscillator must be enabled. If the bit is not enabled, additional current will be drawn and the clock might not operate.

Table 4. RTC LIST

P-WELL Devices	First Generation N-WELL Devices	Second Generation N-WELL Devices
DS1202	DS12885	DS1337
DS12885	DS1302	DS1338
DS1283	DS1305/DS1306	DS1339
DS1284	DS1307	DS1672
DS1384	DS1315	
DS14285	DS1500/DS1501	
DS1384	DS1315	
	DS1602	
	DS1670/DS1673/DS1677	
	DS1685	
	DS1688/DS1689	
	DS17285/DS17485/DS17885	

Summary

When using P-WELL and first-generation N-WELL RTC devices, use an RC circuit to achieve the minimum possible timekeeping current.

The second-generation N-WELL devices use only slightly more current with an RC circuit.

Application Note 701: http://www.maxim-ic.com/an701

More Information
For technical questions and support: http://www.maxim-ic.com/support
For samples: http://www.maxim-ic.com/samples
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Related Parts

DS1284: QuickView -- Full (PDF) Data Sheet

DS12885: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS12R885: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1302: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1305: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1306: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1307: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1315: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1337: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1338: QuickView -- Full (PDF) Data Sheet

DS1339: QuickView -- Full (PDF) Data Sheet

DS1340: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1371: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1374: QuickView -- Full (PDF) Data Sheet

DS1384: QuickView -- Full (PDF) Data Sheet

DS1390: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1391: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1392: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1393: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS14285: QuickView -- Full (PDF) Data Sheet

DS1500: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1501: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1558: QuickView -- Full (PDF) Data Sheet

DS1602: QuickView -- Full (PDF) Data Sheet

DS1670: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1672: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1673: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1677: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1678: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1685: QuickView -- Full (PDF) Data Sheet -- Free Samples

DS1688: QuickView -- Full (PDF) Data Sheet

DS1689: QuickView -- Full (PDF) Data Sheet

DS17285: QuickView -- Full (PDF) Data Sheet -- Free Samples

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DS17885: QuickView -- Full (PDF) Data Sheet -- Free Samples

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