Real Time Clock Back-up Using EnerChip Solid State Batteries

Steps for Designing Superior RTC Back-up Designs

1. Backing up time and/or data registers?
2. What is the sleep current draw of the RTC device
3. Determine back-up time - 99.7% are < 4 hours
4. Is small footprint, thin package important
5. Is a Power Management function needed
6. Avoiding today's issues with coin cells or supercaps
7. Is battery replacement or disposal important
8. Is SMT, RoHS & auto assembly needed

EnerChip Back-up for Various RTC Vendors

Manufacturer	Part Number	Description	Iq (nA)	Backup Time (hours)		
				CBC3105 (4 x 5 Pkg)	CBC3112 (7 x 7 Pkg)	CBC3150 (9 x 9 Pkg)
NXP	PCF2123TS/1,118	SPI RTC/CALENDAR	110	45	109	455
Micro Crystal	RV-2123-C2	RTCMODULE WITH SPI BUS	130	38	92	385
NXP	PCF8523	REAL-TIME CLOCK AND CLAENDAR I2C	150	33	80	333
Epson	RX-8571	REAL TIME CLOCK I2C	220	23	55	227
Seiko	S-35390A-J8T1G	RTC I2C 2-WIRE	250	20	48	200
Seiko	S-35390A-I8T1G	REAL TIME CLOCK 2WIRE	250	20	48	200
NXP	PCF8563BS/4,118	CMOS RTC/CALENDAR	250	20	48	200
NXP	PCF8563T/5, 518	I2C RTC/CALENDAR 8SOIC	250	20	48	200
Epson	RX-8564	REAL TIME CLOCK I2C	275	18	44	182
Maxim	DS1341	I2C for HIGH ESR CRYSTALS	280	18	43	179
Maxim	DS1342	I2C for HIGH ESR CRYSTALS	310	16	39	161
Pericom	PT7C4337WEX	I2C RTC ALARM 8SOIC	350	14	34	143
Maxim	DS1305EN+T&R	RTC SERIAL ALARM IND	400	13	30	125
Intersil	ISL1208IU8Z	RTC/CALENDAR I2C	400	13	30	125
Maxim	DS1372	RTC I2C BINARY COUNTER CLOCK	400	13	30	125
Epson	RX-8581	REAL TIME CLOCK	450	11	27	111
Maxim	DS1307Z+T&R	RTC SERIAL 512K	480	10	25	104
Maxim	DS1390U-33+	RTC w/TRICKLE CHG. & PWR FAIL DET.	500	10	24	100
Microchip	MCP79410T-I/SN	I2C RTC/CALENDAR EEPROM 8SOIC	700	7	17	71
Texas Instruments	BQ32000	SERIAL RTC w/BACKUP & TRICKLE CHG.	1200	4	10	42

Power Back-up for Microelectronics

Real Time Clocks, MCUs, SRAM, etc

How long does Back-up Power need to last?

- Many microelectronic designs have data or status information that must retained during a primary power interruption.
- There are different types of power interruptions that must be handled
- Designers have several options for Power Back-up including EnerChip Solid State Batteries

Types of Power Interruptions

- AC commercial power outage
- AC/DC equipment power supply failure
- Change out of primary battery
- Failure of primary battery (depends on if condition is alarmed, or interval of manual inspection)
- Initial power-up setting of device in factory test, package/ship/store, then power on by end-user (depends on delivery and deployment schedule)

AC Power Interruption Data Points for Single User UPS systems

- 90% of AC power outages are less than 5 minutes in duration
- 99% of AC power outages are less than 1 hour in duration
- Total cumulative AC outage duration is ~100 minutes per year.
- Manual intervention of blown fuse/circuit breaker or AC/DC converter failure typical worst case is 87 hours – (long weekend 5PM Friday to 8AM Tuesday)

Source: Schneider Electric APC Division

Utility Company AC Power Outage Quality of Service Data Metrics

- The Utility industry uses three key metrics for power interruptions
  - SAIDI – System Average Interruption Duration Index.

SAIDI = Sum of customer (sustained) Interruption minutes for all customers
Total Number of customer served

  - SAIFI – System Average Interrupt Frequency Index.

SAIFI = Total number of customer (sustained) Interruptions for all customers
Total Number of customer served

  - MAIFI – Momentary Average Interrupt Frequency Index.

MAIFI = Total number of customer (sustained) Interruptions for all customers
Total Number of customer served

Note: IEEE definition of sustained interruption is greater than 5 minutes

Detailed SAIDI and SAIFI Statistics

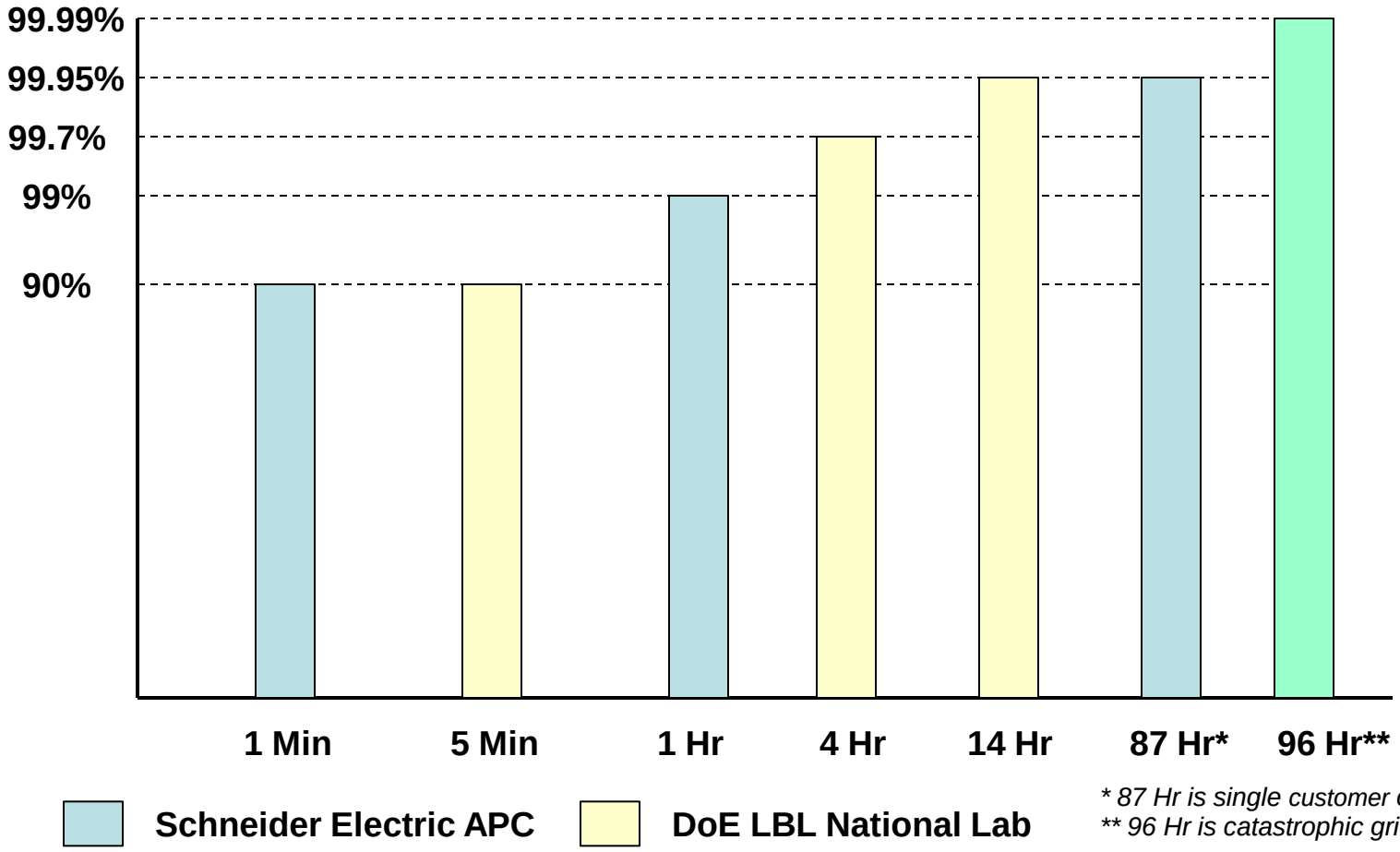
- Data collected from the 23 U.S. State PUCs (where annual Utility reporting is required) over a period of 11 years.
- To insure that interruption data is useful for electronics back-up power calculation, long duration outlier data is kept in the statistics.
- SAIDI total mean = 122 minutes with 115 Std Dev
- SAIFI total mean = 1.3 times per year, Std Dev .5
- MAIFI total mean = 4.6 times per year,Std Dev 4.1

Source: U.S. DoE Lawrence Berkeley National Laboratory "Understanding the Cost of Power Interruptions to U.S. Electricity Consumers " Kristina Hamachi LaCommare and Joseph H. Eto

Conclusions from the LBL Data and Circuit Breaker outages

- Average of sustained interruptions is 122 minutes. Include the STD Deviation and the longest duration is 237 min or ~4 hours.
- Frequency of interruptions is using Avg and Std Dev: 1.3 + 0.5 +4.6 + 4.1 = 10.5/year
- Worst case single AC interruption time in LBL study was 14 hours. However, some catastrophes (e.g. Hurricane Katrina) had outages lasting 96 hours.
- For electronics sourced from unalarmed/unattended AC breakers, it could be possible that the breaker is not reset over a three day weekend of 87 hours.

Comparison of Outage Data Results for Design Rules



** 87 Hr is single customer occurrence*
*** 96 Hr is catastrophic grid destruction*

Back-up Power Design Duration Requirements

- Change-out of primary battery in electronics device power back-up duration for 15-30 minutes
- Commercial AC power interruptions power back-up duration for is 4 hours for 99.7% of all outages. 14 hours was worst case.
- Power Back-up duration for equipment connected to circuit breakers that are not alarmed is 87 hours.
- Choice of battery for RTC, MCU and/or SRAM back-up should provide these durations.

EnerChips Provide Adequate RTC Back-up for Every Situation

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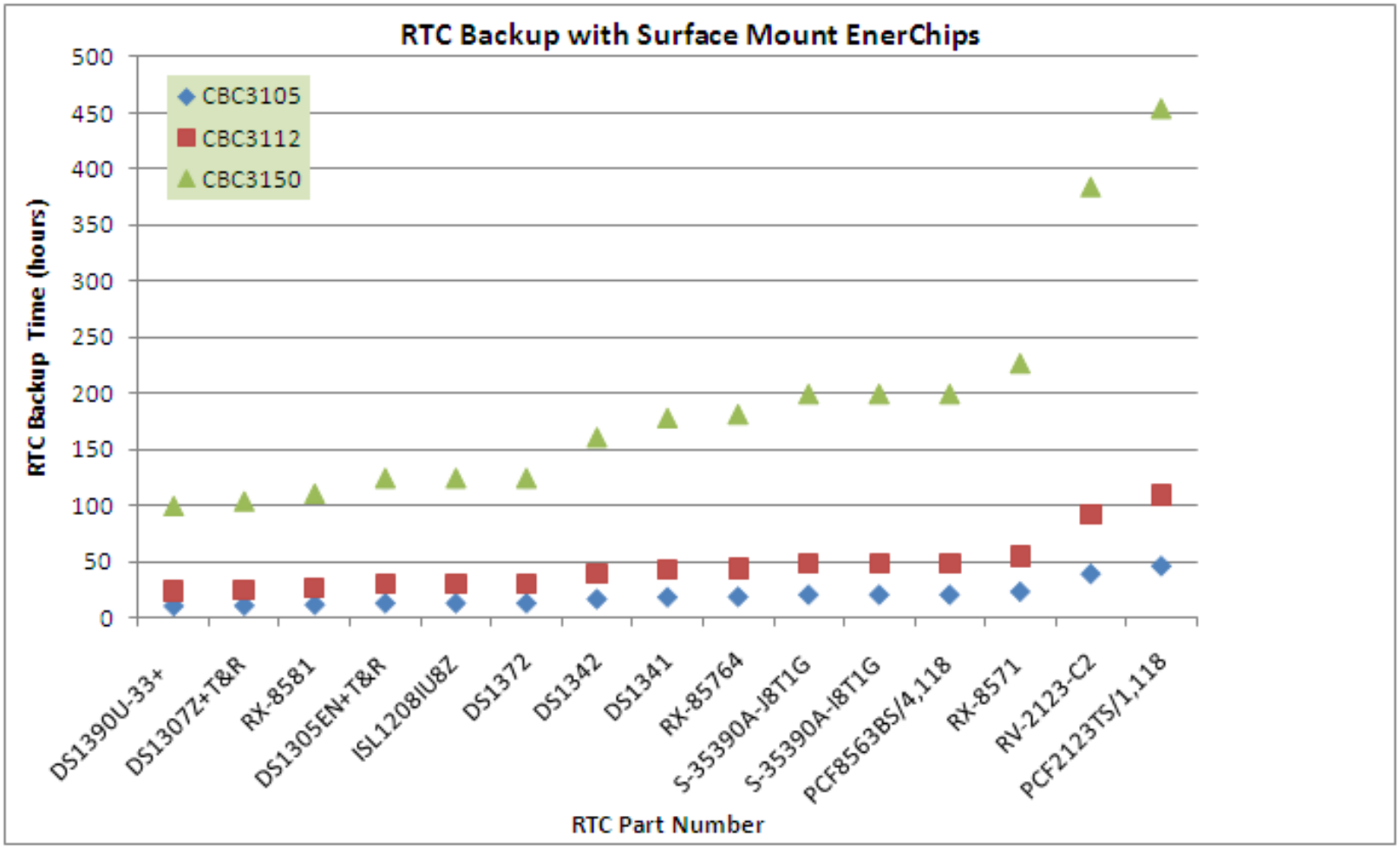
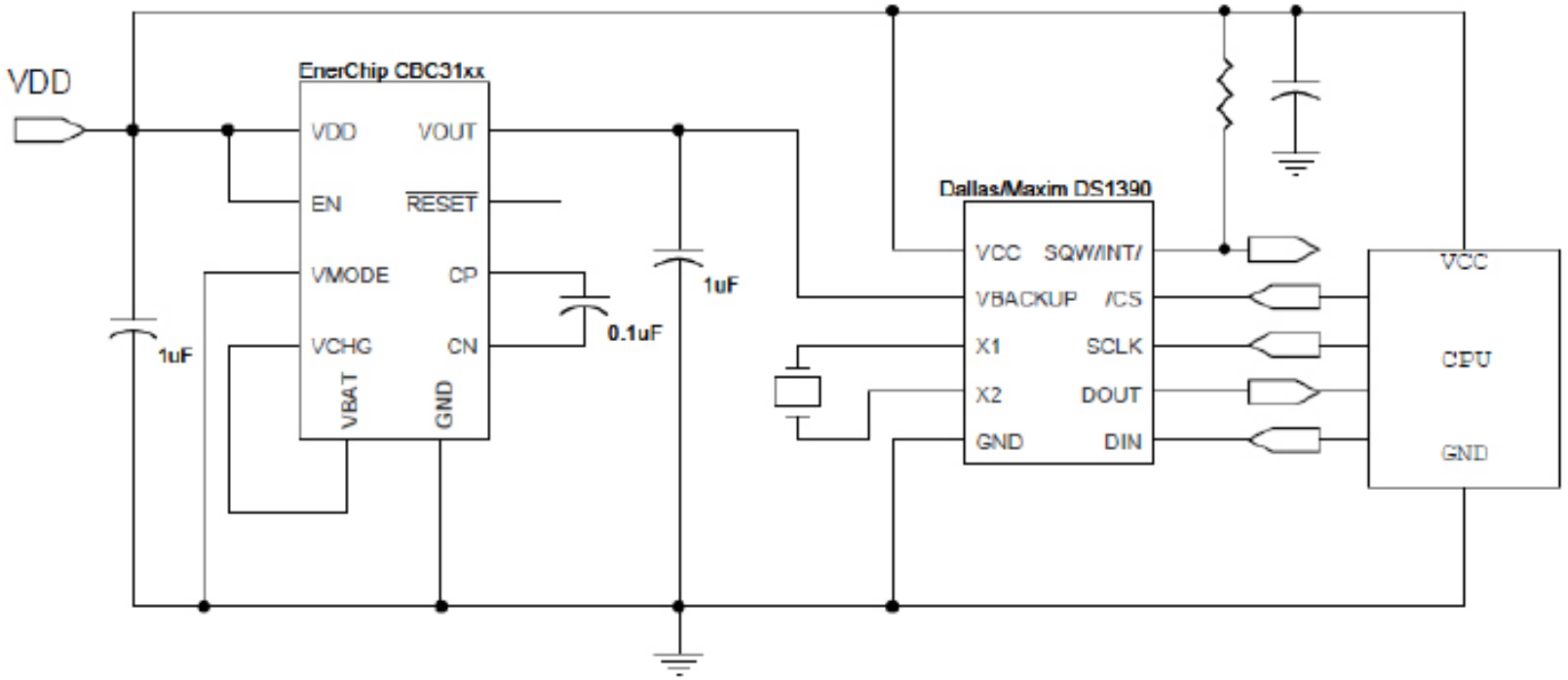
EnerChip RTC Back-up Times



EnerChip RTC Back-up is a Simple Drop-in Solution



EnerChips are Ideal for RTC Back-up

- EnerChips can be sized to handle any RTC back-up holdover interval
- EnerChips have a small, thin form factor
- EnerChips use surface mount technology, reflow solder tolerant and RoHS
- EnerChips have no special disposal process and are safe for air transport
- EnerChips last the life of the product – no battery change out is required.

EnerChips Are Globally Available

Digi-Key CORPORATION

AVNET Abacus

OPTO-SENSOR

MOUSER ELECTRONICS

GLOBAL ELECTRONICS

SEAMAX

Premier Farnell

Infinite Ideas
MSYS
丸紅情報システムズ

AVNET Asia