

Powerency SSC Devices for RTC Power Backup

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Nowadays Real Time clocks (RTC) are commonly used in many kind of applications from consumer electronics to IoT systems. RTC keeps accurate track of time even when a power supply is turned off or a device is placed in low power mode. ITEN Solid State Ceramic (SSC) Power Device offer the ideal solution, providing long-lasting, stable power to ensure your RTCs perform optimally under all conditions

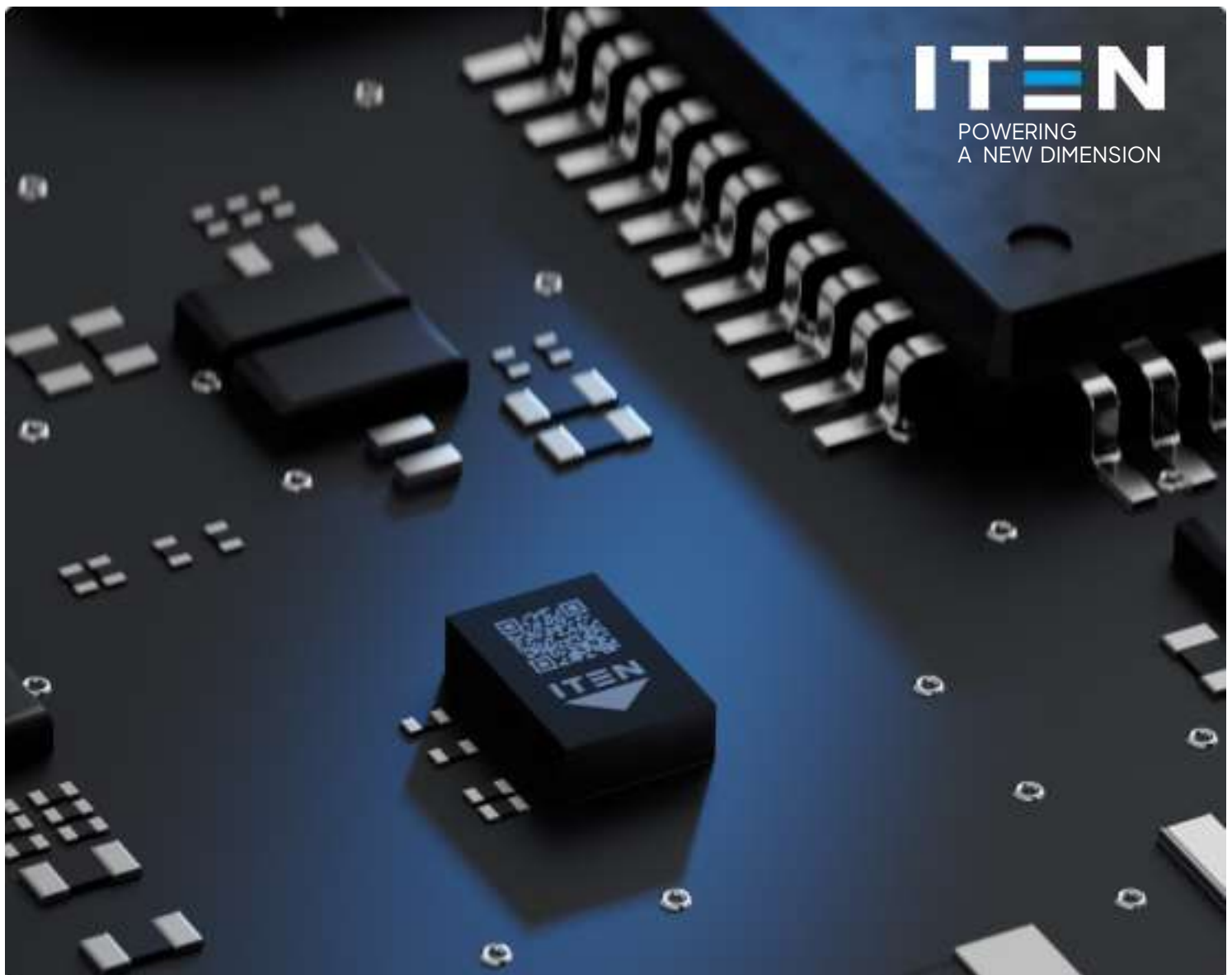


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Overview

The purpose of this document is to highlight the advantages of using ITEN Solid State Ceramic (SSC) Power Devices for powering Real-Time Clock (RTC) integrated circuits (ICs). By providing a reliable power source, ITEN SSC devices ensure that RTCs can maintain accurate timekeeping even when the main system is powered down, thereby enhancing the overall functionality and reliability of electronic devices in an eco-friendly and compact design.

Importance of a Reliable Back-Up Solution for RTCs

RTCs need to keep accurate time even when the primary power source is unavailable. A reliable energy storage is critical for maintaining continuous operation and data integrity. Accurate timekeeping is vital for timestamping and logging events, especially in systems where precise timing is crucial, such as in data servers, security systems, and industrial control applications. ITEN SSC devices are designed to deliver consistent power, ensuring that your RTCs continuously operate during power outages, system shutdowns, or energy storage replacement in the main device. ITEN SSC devices long lifespan and rechargeable remove the need of replacement compared to standard batteries. This reduces maintenance efforts and costs, making it an economical choice for long-term projects and devices deployed in remote or hard-to-reach locations.

Features of ITEN SSC Power Devices

01 Voltage

ITEN Powency PWY0150S and PWY0250S can be used from 2.7V to 1.5V, which make them compatible with most of ultra-low power RTC modules. Unlike conventional batteries, ITEN technology allows the device to safely reach 0V without damage or safety risks, ensuring superior reliability and longevity.

02 Fast Charge

With its unique material composition, 80% of the energy storage can be charged in 8 minutes at room temperature using a constant voltage of 2.7V as shown on Figure 1 below. Such charging configuration can be easily done with embedded trickle charging system of RTC modules.

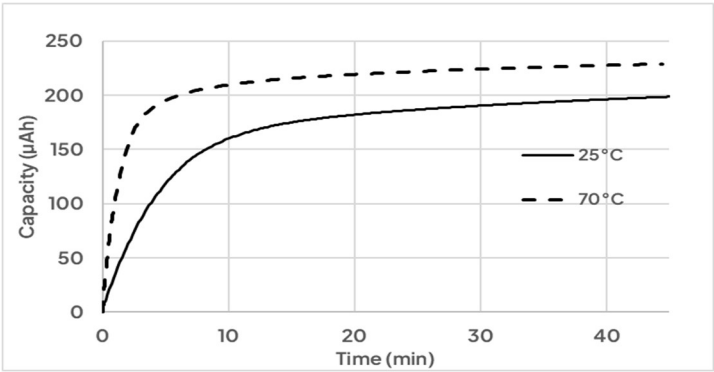


Figure 1: Charging curves of PWY0150S

03 Capacity

ITEN Powency portfolio includes 150µAh and 250µAh and can support low-power RTCs for weeks without main power sources (please refer to part 6 for case study). Both models can also support 30mA peak for 100ms. If additional capacity is required, SSC devices can be put in parallel without the need to use specific BMS IC.

04 Longevity

ITEN SSC devices have been designed to last at least 1000 cycles at 100% DoD, which means that the system can be used for decades before needing the ITEN POWENCY to be replaced

05 Low Self-Discharge

Powency SSC components are designed to deliver good self-discharge performance, ensuring minimal energy loss over extended periods. Below is a summary of self-discharge performance of Powency SSC devices

Powency Reference	Self-discharge per day	Self-discharge per hour
PWY0150S	5µAh	208nA
PWY0250S	8.3µAh	347nAh

06 Temperature Range and Stability

Thanks to its 100% ceramic structure, ITEN SSC devices are designed to operate without experiencing thermal runaway, ensuring stable performance even under high-temperature conditions. ITEN SSC devices can operate from -20°C to 70°C

07 Size and Compatibility

ITEN Powency SSC devices fit in a tiny QFN package (3.5 x 5.1 x 1.6 mm), which offers unmatched energy and power density. Their miniature form-factor ensure to fit in various embedded systems, such as IoT or wearable electronics applications. Its compliance with low temperature (165°C) Solder & Reflow makes it easy to integrate on printed circuit boards.

08 Certification and Safety

ITEN SSC devices are RoHS and REACH compliant. Its 100% Ceramic structure makes it very safe and immune against thermal runaway.

Benefits of Using ITEN SSC Power Devices for RTC Back-Up Applications

Extended Device Uptime

Using ITEN POWENCY as back-up could extends the operational uptime when the main power is missing

Maintenance Reduction and Cost Efficiency

Thanks to its rechargeable feature, using ITEN SSC devices would remove the need to replace the energy storage element, hence significantly reduced the maintenance cost of the system compared to typical coin cells .

Integration and Compatibility

Integration Guidelines

Please follow the guidelines below to ensure proper integration of the SSC devices for RTC backup applications, optimizing performance and reliability

- 1. Please make sure the RTC operating voltage match the working voltage range of the ITEN SSC devices (2.7V – 1.5V)
- 2. In order to reduce the number of components on the board, hence the compactness of the design, preferably use components with integrated voltage regulators as shown in the following architecture

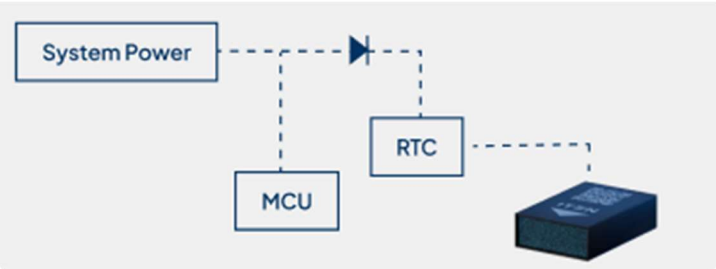


Figure 2: Architecture for RTC back-up with integrated voltage regulator

In case the RTC IC doesn't offer an integrated voltage regulator, a DC/DC converter(LDO, Boost, Buck depending on the power supply) would need to be added into your design to charge the ITEN POWENCY at 2.7V as required

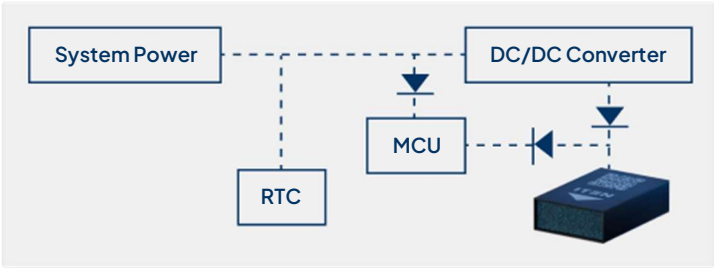


Figure 3: Architecture for RTC back-up with external DC/DC Converter

Please note that reverse current protection would be needed to avoid discharging the SSC devices when the source goes missing.

- 3. In order to optimize the backup period, please select the RTC (and DC/DC converter) with the lowest consumption possible

Supported RTC Models

Please find below a non-exhaustive list of ultra-low-power RTC ICs with trickle charger that are compatible with ITEN Powency SSC devices.

Supplier	IC Reference	Operating Voltage Range	Current Consumption @ 3.0V
Ambiq	AM18X5	1.5 – 3.6V	14 nA
Abrakon	AB-RTCMC	1.5 – 3.6V	17nA
EM Micro	EM3028	1.2 – 5.5V	40 nA
Micro Crystal	RV-3028-C7	1.1 – 5.5V	45 nA
Analog Devices	MAX31331	1.1 – 5.5V	65 nA

Table 2: Non-exhaustive list of ultra-low-power RTC ICs compatible with ITEN Powency SSC devices

Please refer to the associated datasheets for further details

If you want to use ITEN SSC devices with a RTC which isn't included in this list, feel free to contact ITEN technical support for system review and integration recommendations.

Case Studies / Examples

Ambiq AM18X5 and Abracon AB18X5

As both RTC ICs are quite identical, similar implementation and configuration can be used

Recommended Implementation:

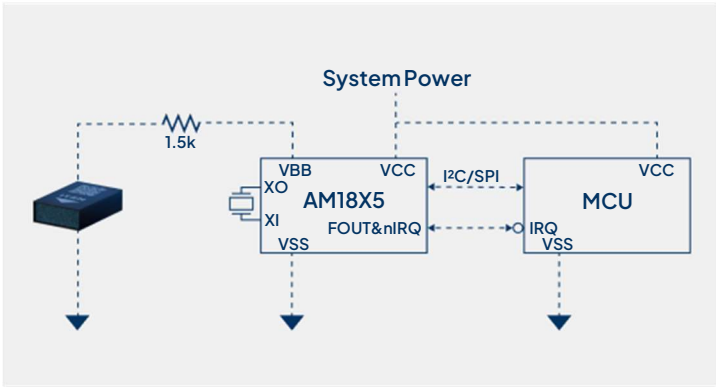


Figure 4: Recommended integration of ITEN POWENCY with AM18X5 and AB18X5 RTC

Recommended RTC configuration:

- Power Supply Vcc**
Ensure that the RTC's VCC is higher than ITEN POWENCY charging voltage (typically $VCC > 2.7V$). A VCC of 3.3V is recommended.
- Oscillator mode**
In order to reduce the consumption of the RTC, RC oscillator mode is recommended
- Trickle Charge Configuration**
Set up the trickle charge path to provide a safe current and maintain the SSC device voltage near 2.7V. Follow these steps:
 - Enable the trickle charge function by writing value 1010 in [7:4] bits of Trickle register 0x20
 - Choose standard Diode with 0.6V voltage drop so that voltage charge of the SSC devices = $3.3V - 0.6V = 2.7V$, hence write 10 in [3:2] bits of 0x20 Trickle register
 - Trickle Charge Resistor can be disabled as no current limit is required to charge the SSC device, hence write 00 in [1:0] bits of 0x20 Trickle register
 - Complete 0x20 Trickle register value to write is then 10101000
- Battery Monitoring and Control**
In order to adapt the reference voltages to ITEN POWENCY voltage in the Wakeup Control, please set 0x21 BREF Control register to the value 11010000

Power Backup Time

Using this above configuration, here is the typical backup time that

Component	Leakage	Power Backup Time
AM18X5	14nA	-
PWY0150S	208nA	-
Total	222nA	28 days

Table 3: Expected backup time using PWY0150S with AM18X5 RTC

Component	Leakage	Power Backup Time
AM18X5	14nA	-
PWY0250S	347nA	-
Total	361nA	29 days

Table 4: Expected backup time using PWY0250S with AM18X5 RTC

EM Microelectronic EM3028

Recommended Implementation:

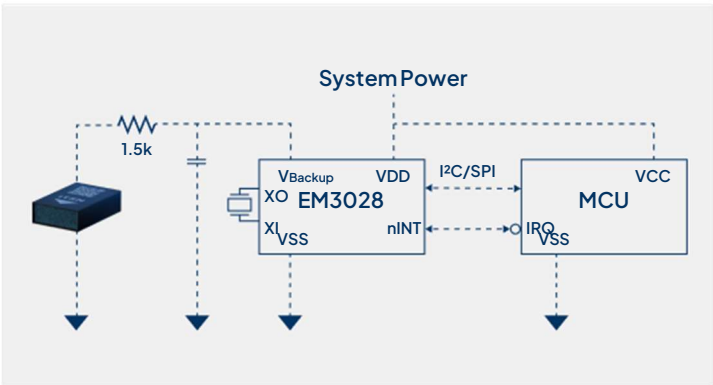


Figure 5: Recommended integration of ITEN POWENCY with EM3028 RTC

Recommended RTC configuration:

- Power Supply Vcc**
Ensure that the RTC's VCC is higher than the ITEN POWENCY charging voltage (typically $VCC > 2.7V$). A VCC of 3V is recommended.
- Oscillator mode**
In order to reduce the consumption of the RTC, RC oscillator mode is recommended
- Trickle Charge Configuration**
Set up the trickle charge path to provide a safe current and maintain the SSC devices voltage near 2.7V. Follow the following steps

- Enable the trickle charge function by writing 1 in bit 5 of Trickle register 0x37
- In order to optimize Switchover Function between Main Power and Back up, please write 11 in [3:2] bits of 0x37 Trickle register
- Use the smallest Trickle Charge Resistor possible (1 kΩ) as no current limit is required to charge the SSC device, hence write 00 in [1:0] bits of Trickle register 0x37
- Complete 0x37 Trickle register value to write is then 00101100

Power Backup Time

Using this above configuration, here is the typical backup time that

Component	Leakage	Power Backup Time
EM3028	45nA	-
PWY0150S	208nA	-
Total	253nA	25 days

Table 5: Expected backup time using PWY0150S with EM3028 RTC

Component	Leakage	Power Backup Time
EM3028	45nA	-
PWY0250S	347nA	-
Total	392nA	27 days

Table 6: Expected backup time using PWY0250S with EM3028 RTC

Conclusion

RTCs need to keep accurate time even when the primary power source is unavailable. A reliable energy storage is critical for maintaining continuous operation and data integrity.

About Us

I-TEN SA is a French industrial gem, leader in the development and production of solid-state technologies with unrivalled power density. It is one of the few global players with the capacity for industrial production of this technology, mastering the entire design and production chain. These revolutionary components meet the power and miniaturization needs of electronic systems used in connected objects, autonomous sensors and wearables.

At the heart of the French DeepTech ecosystem, ITEN holds over 200 patents. ITEN is the two-time winner of the global innovation competition in 2015 and 2017, the French Tech 120 winner in 2023 and 2024 and won the CES 2024 Best of Innovation Awards in Las Vegas for its Powency 250μAh device (the second French company to be honoured since CES was founded in 1967).

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Revision History

Date	Version	Changes
2025/11/07	V1.2	Minor wording adjustments; no change in meaning
2025/04/17	V1.1	Update file template
2025/01/31	V1.0	Initial version

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