

## EPSON TIMING DEVICES

Offers a diverse range of industry-leading timing devices, kHz/MHz Crystal, SPXO, VCXO, TCXO and RTC module. Epson's RTC modules ensure efficiency with **reduced power consumption**, **exceptional accuracy**, and **simplified system design**.

## WHAT IS REAL-TIME CLOCK (RTC) ?

- Independent time tracking like alarms, timers, timestamps, and scheduling.
- Equipped with its own power source, ensuring continuous operation.
- Utilizes kHz crystal for accurate, reliable timekeeping across diverse applications.

## EPSON BENEFITS

- **Built-in Crystal** : Eliminates matching effort, Simplify designs process.
- **Exceptional Performance** : Long backup times, High accuracy with built-in DTCXO.
- **Comprehensive Product Lines** : One stop shop with expansive features & options.
- **Vertical Integration** : Total Quality Control, Autonomous Supply management.

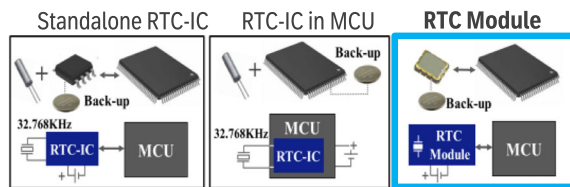
## RTC KEY FEATURES & FUNCTIONS

- Time Stamp : Records events from external sources.
- Alarm & Wake-up Timer : Generates Interrupt event.
- Automatic Power Switch : Supply back-up supply when main supply fails.
- Calendar, Scheduling, Reset Control.

## CUSTOMER CHALLENGES

- Accuracy over Temperature
- Power Consumption
- Back-up time

## RTC ARCHITECTURES



**No Circuit Matching:** Save design time, Resources & Cost

External Crystal: Requires circuit matching Built-in crystal

## RTC MODULE ADVANTAGE VS. RTC-IC IN MCU

Advantages	RTC Module	RTC-IC IN MCU
<b>Low Power Consumption</b>	• Enables Low-power sleep mode in MCU	• MCU needs minimal operating for RTC
<b>Longer Back-up Time</b>	• Backup battery range: 4.5V to 1.1V	• Backup battery range: 3.3V to 1.6V
<b>High Accuracy</b>	• Tolerance only from RTC Module	• Tolerance from: Crystal + MCU + Stray Capacitance
<b>Independency</b>	• Operates independently of MCU	• Relies on host processor operation
<b>No Circuit Marching</b>	• Factory Calibration	• Requires Crystal validation

## DELIVERABLES TO CUSTOMERS

### Development Tools



### Epson provides

- [Support for Customer to update firmware with Epson RTC.](#)
- Development Tools, PC GUI, Qual Report.
- 7 Days/24 Hours Real Time Response to the Questions & Inquiries.

## RTC MODULE APPLICATIONS

### Key Requirement for Variety of Applications

- Accurate Time Information.
- High Stability against temperature fluctuation.
- Low power consumption & Long Backup time.
- Back-up power supply with automatic power switching.
- Compact design for limited board space applications.

### Factory Automation

Applications	Use Cases	Epson Benefits
• PLC / VFD	• Timer: Process controls	• Accuracy
• Motor Drive	• Timestamps: Record events	• High Stability
• Computer/HMI	• Scheduling: Maintenance tasks	• Reliability

### Industrial Devices

Applications	Use Cases	Epson Benefits
• Smart Meters	• Alarms, Calendar & Timers	• High Stability
• Surveillance	• Timestamps: Data collection	• Low power
• Industrial IoT	• Trigger Alarms: Monitor areas	• Compact design

### Medical Devices

Applications	Use Cases	Epson Benefits
• Patient Monitor	• Timekeeping: Medication	• Accuracy
• BGM / CGM	• Trigger Event: Detect changes	• Low backup current
• Infusion Pump	• Timestamps: Diagnosis	• 32 Timestamps

### Automotive

Applications	Use Cases	Epson Benefits
• Infotainment	• Timekeeping: system control	• Accurate operation
• BMS	• Timestamps: Self monitoring	• Efficient functionalities
• VCG	• Endure harsh operation	• Enhanced reliability

## YOUTUBE VIDEO FOR KEY APPLICATIONS

- Smart Meter
- Smart Street Light
- Factory Automation
- Remote IoT Sensor
- Camera & Security
- EV Battery Management
- Monitoring System
- Ethernet Switch



## KEY QUESTIONS TO CUSTOMERS

### Check with the Customers (with engineers if possible)

- What is the applications/industries ?
- What are the use cases (or purposes) of using an RTC?
- If using RTC Embedded MCU, Any reason why can not use RTC Module?
- What are the crucial requirements to select RTC ?
- Are you familiar with RTC products ?

## CALL TO ACTION

- Understand about key required features & functions of RTC: Use "EPSON RTC MODULE SELECTION GUIDE" session
- Narrow down to 2-3 EPSON products and provide datasheets.
- Setup a product update meeting with Epson PMM and Customers.
- Verify RTC product information of competitors and provide cross.

## YOUR EPSON CONTACTS

### Consumer & Industrial

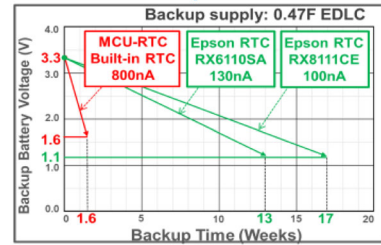
- Jonny Lee
- jonny.lee@ea.epson.com

### Automotive

- Hensen Wong
- hensen.wong@ea.epson.com

## EPSON RTC MODULE EXCEPTIONAL PERFORMANCE

### Unmatched Backup Time

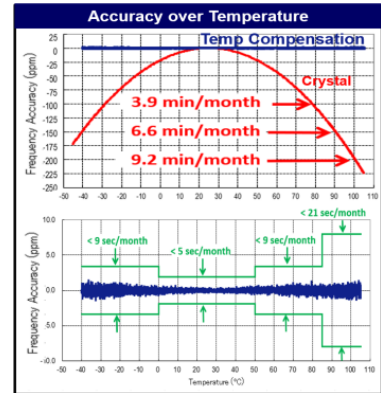


- 10 times longer than MCU-RTC**
- MCU RTC (Built-in RTC) : 1.6 weeks
  - Epson RTC (RTC Module) : 17 weeks

### Major Enabler in Epson RTC

- Low Current during backup mode.
- Wide range of backup supply voltage.

### Superior Accuracy with Temperature Compensation



### Time error worsens w/ crystal only

- Natural kHz Crystal frequency drifts due to temperature and aging.
  - Large time errors at temp. extremes.
- 3.9min/m @ +85C    9.2min/m @ +100C

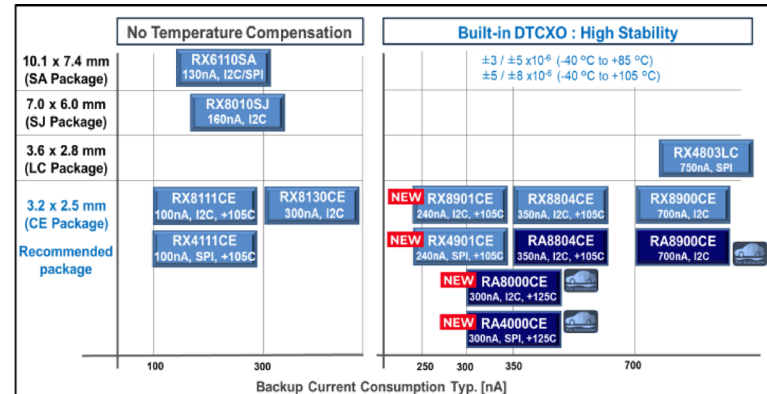
### Epson RTC with built-in DTCXO

Superior Accuracy over wide Temp. range.

- ±3.4ppm (-40 to +85C) : **9 seconds/month (vs. 3.9min/month)**
- ±8.0ppm (-40 to +105C) : **21 seconds/month (vs. 9.2min/month)**

## EPSON RTC MODULE PORTFOLIO

Wide range of RTC modules with built-in Crystal & embedded temperature compensation simplify system design and provide superior accuracy. Thanks to a rich set of optional functions, Epson RTC module products cover multiple tasks.



### Takeaways

- Covers Consumer, Industrial and Automotive
- High stability, low power consumption

### Questions to the Customers

- Which industry? Application ?
- Which RTC product is engaged ?

## RTC MODULE FOR CONSUMER & INDUSTRIAL

	RX8130CE	RX8111CE	RX8900CE	RX8804CE	RX8901CE
DTCXO			✓	✓	✓
Interface	I <sup>2</sup> C	I <sup>2</sup> C	I <sup>2</sup> C	I <sup>2</sup> C	I <sup>2</sup> C
Operating Temp.	+85 °C	+105 °C	+85 °C	+105 °C	+105 °C
Accuracy	±3.4 @-40~+85°C	±3.4 @-40~+85°C	±3.4 @-40~+85°C	±3.4 @-40~+85°C ±8.0 @+85~+105°C	±3.0 @-40~+85°C ±5.0 @+85~+105°C
Backup Current Typ.	300 nA	100 nA	700 nA	350 nA	240 nA
Time Stamp (Max.)		8 times		1 times	32 times
Power Switching	✓	✓	✓		✓
Reset output	✓				
SPI Interface		RX4111CE			RX4901CE

### Takeaways

- RX8xxx / RX4xxx: I<sup>2</sup>C or SPI. Same features
- RX8901 / RX4901CE: All-in-One features

### Questions to the Customers

- Any missing parameters ?
- Most important features ?

## RTC MODULE FOR AUTOMOTIVE

	RA8900CE	RA8804CE	RA8000CE	RA4000CE
DTCXO	✓	✓	✓	✓
Interface	I <sup>2</sup> C	I <sup>2</sup> C	I <sup>2</sup> C	SPI
Operating Temp.	+85 °C	+105 °C	+125 °C	+125 °C
Accuracy	±3.4 @-40~+85°C	±3.4 @-40~+85°C ±8.0 @+85~+105°C ±8.0 @+85~+105°C	±5.0 @-40~+85°C ±8.0 @+85~+105°C ±50 @+105~+125°C	±5.0 @-40~+85°C ±8.0 @+85~+105°C ±50 @+105~+125°C
Backup Current Typ.	700 nA	350 nA	300 nA	300 nA
Time Stamp (Max.)		1 time	2 times	2 times
Power Switching	✓			
Reset output			✓	✓
Automotive	AEC-Q200	AEC-Q100	AEC-Q100	AEC-Q100

### Takeaways

- Automotive Compliance, AEC-Q100 / Q200
- High Stability over Temp. Compensation

### Questions to Customers

- Need built-in power switch?
- Most important features ?

## YOUTUBE VIDEO FOR NEW PRODUCTS

- RX8901CE / RX4901CE Introduction
- RX8111CE
- RA8000CE / RA4000CE Introduction
- RX4111CE



## COMPETITION ANALYSIS

	Epson	Abiu	Adonidia	McIntosh	Nectarine	Starfruit
Built-in Crystal	✓(100%)	No	✓	✓(100%)	✓	✓
Built-in DTCXO	✓	No	✓	✓	✓	✓
High Stability	±3.4ppm (-40~85°C) ±8.0ppm (-85~105°C)	N/A	±3.5ppm (-40~85°C)	±3ppm (-40~85°C) ±7.0ppm (-85~105°C)	±3ppm (-40~85°C) ±8.0ppm (-85~105°C)	±5ppm (-40~85°C)
Lowest Backup Current (Typ.) (Built-in Crystal)	Down to 100nA	Down to 250nA	Down to 240nA	Down to 45nA	Down to 350nA	Down to 500nA
Industrial Grade (-40~105°C)	✓	✓	No	✓	✓	No
Automotive AEC-Q100/200	✓	✓	No	✓	✓	No

## EPSON RTC MODULE SELECTION GUIDE

✓ MCU Interface	I <sup>2</sup> C? or SPI ?
✓ Package Size	Compact board design ?
✓ Accuracy	Temperature compensation ?
✓ Operating Temp.	Industrial? Automotive ?
✓ Back-up Current	Longer backup time ?
✓ Other Features	Timestamp, User memory ?



### Questions to the Customers

- A most crucial factor to select RTC module ?

### Epson RTC Module Product Page

Model (Size: 3.2 x 2.5 mm)	Inter-face	Built-in DTCXO	Stability (ppm)		Operating Temp.	Backup Current(μA)	
			-40 to +85C	+85 to +105C		Typ.	Max.
RX8130CE	I <sup>2</sup> C	-	-	-	-40 to 85C	0.3	0.5
RX8111CE/RX4111CE	I <sup>2</sup> C/SPI	-	-	-	-40 to 105C	0.1	0.45
RX8900CE	I <sup>2</sup> C	✓	±3.4	-	-40 to 85C	0.7	1.4
RX8901CE/RX4901CE	I <sup>2</sup> C/SPI	✓	±3.0	±5.0	-40 to 105C	0.24	1.5
RX8804CE	I <sup>2</sup> C	✓	±3.4	±8.0	-40 to 105C	0.35	1.5
RA8000CE (AEC-Q100)	I <sup>2</sup> C	✓	±5.0	±8.0	-40 to 125C	0.3	1.7
RA4000CE (AEC-Q100)	SPI	✓	±5.0	±8.0	-40 to 125C	0.3	1.7
RA8804CE (AEC-Q100)	I <sup>2</sup> C	✓	±3.4	±8.0	-40 to 105C	0.35	1.5
RA8900CE (AEC-Q200)	I <sup>2</sup> C	✓	±3.4	±8.0	-40 to 85C	0.7	1.4