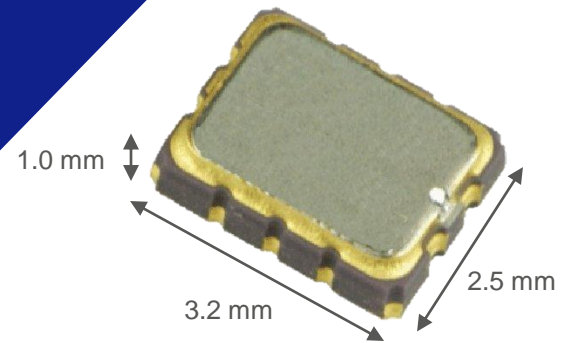


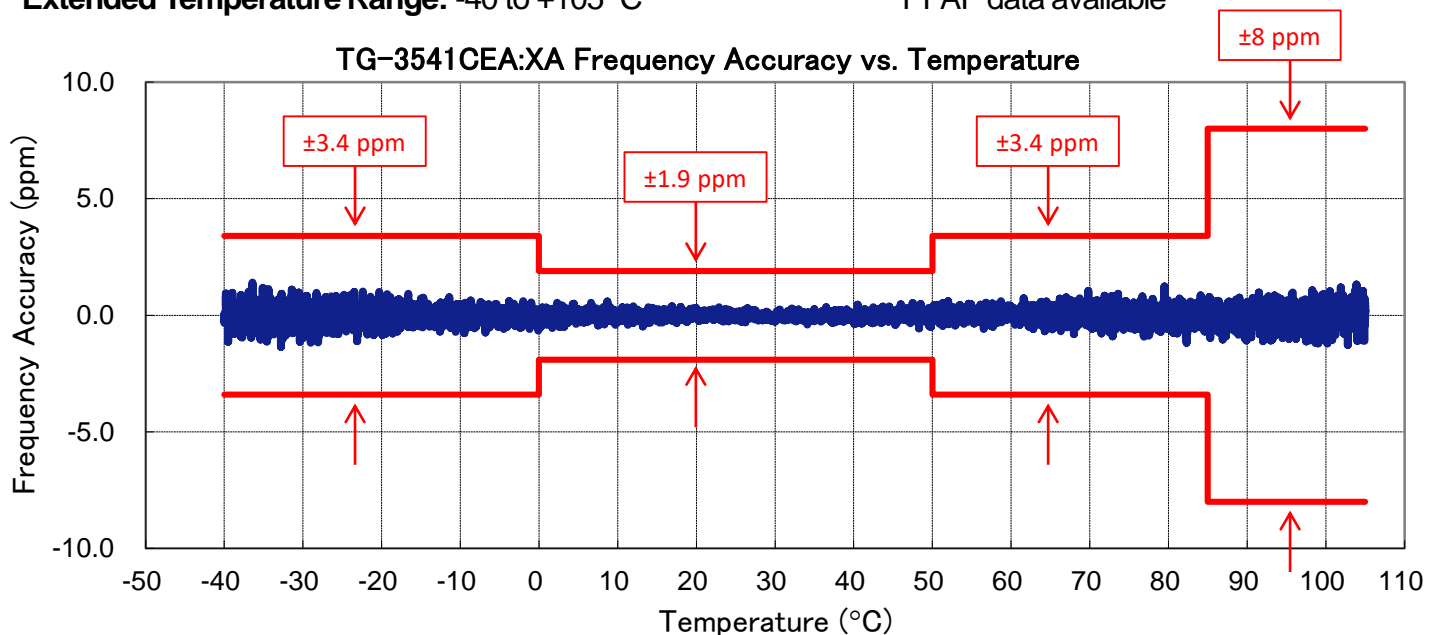
# Automotive 32.768 kHz DTCXO

High Accuracy. Low Power. Extended Temperature.



## Epson TG-3541CEA Automotive DTCXO

- **Frequency:** 32.768 kHz
- **High Accuracy:**  $\pm 3.4$  ppm -40 to +85 °C ( $\pm 9$  s/mo.)  
 $\pm 8.0$  ppm +85 to +105 °C ( $\pm 21$  s/mo.)
- **Low Power:** 0.6  $\mu$ A typ(1.8V) 1.0  $\mu$ A typ(3.0V) No load condition
- **Extended Temperature Range:** -40 to +105 °C
- **Supply Voltage:** 1.5 to 5.5 V
- **Output:** CMOS
- **Small Size:** 3.2 x 2.5 x 1.0 mm
- **AEC-Q100 Grade 2 Qualified,** PPAP data available



Epson's TG-3541CEA is a precision frequency reference designed for automotive applications including

- Infotainment : Car Navigation, Car Audio, Car clocks
- Communication : eCall, Electronic Toll Collection, V2X
- Others : EV battery management, Body control.

Using Epson's Digitally Temperature-Compensated Crystal Oscillator (DTCXO) technology, Epson's TG-3541CEA achieves accuracy of  $< \pm 3.4$  ppm from -40 to +85 °C or  $< \pm 8$  ppm up to +105 °C, equivalent to only  $\pm 9$  or  $\pm 21$  seconds time error per month respectively. Furthermore, the TG-3541CEA is low power, consuming only 0.6  $\mu$ A, making it the most accurate and lowest power 32.768 kHz oscillator available today.

# Epson TG-3541CEA DTCXO

Epson pioneered Real-Time Clocks by introducing the RTC module in 1986 and the world's first DTCXO RTC in 2008. Epson is the RTC module market leader with #1 share. Epson's DTCXO technology delivers precision time keeping over a wide temperature range.

Epson's TG-3541CEA is a standalone DTCXO which delivers accurate frequency over a wide temperature range. Applications processors and microcontrollers with embedded RTCs can now benefit from precision time keeping in harsh environments.

## ADVANTAGES

- High Accuracy Enabled by DTCXO Technology
- Extended Temperature Range
  - AEC-Q100 Grade 2 Qualified

### High Accuracy Enabled by DTCXO Technology

The accuracy of a conventional kHz crystal oscillator (XO) is determined by the frequency vs. temperature accuracy of a kHz tuning-fork crystal. Conventional kHz crystals and oscillators generally specify accuracy only at room temperature. At 105 °C, conventional 32 kHz XOs are accurate to typically -225 ppm, which is 9.7 minutes per month.

DTCXO technology calibrates the oscillator over temperature to achieve high accuracy over a wide temperature range.

DTCXO technology is only possible with an integrated crystal. Integrating the crystal allows manufacturing calibration of the oscillator/crystal combination and eliminates frequency variation due to loading and board stray capacitances. Epson's DTCXO technology results in a highly accurate 32.768 kHz oscillator that achieves <math>\pm 3.4</math> ppm from -40 to +85 °C and <math>\pm 8.0</math> ppm from +85 to +105 °C. This ensures accuracy of better than  $\pm 9$  seconds per month or  $\pm 21$  seconds per month respectively, which is essential for automotive applications that require precise timekeeping in harsh environments.

### Low Power for Long Battery Life

While it is easy to build digital functions at low power, an oscillator is an analog component. Achieving high accuracy and low power at the same time is very difficult. Using a special low-ESR kHz crystal co-packaged with a DTCXO oscillator and fabricated with low-leakage transistor technology, Epson's TG-3541CEA achieves far better accuracy and lower power, 0.6  $\mu$ A, than other solutions, making it the most accurate and lowest power 32.768 kHz oscillator available today.

### Extended Temperature, Low Power, & High Accuracy

Epson's TG-3541CEA 32 kHz oscillator is specified for the full -40 to +105 °C temperature range. Compared to SiMEMS solutions, Epson's TG-3541CEA is both more accurate and lower power.

### Ordering Options

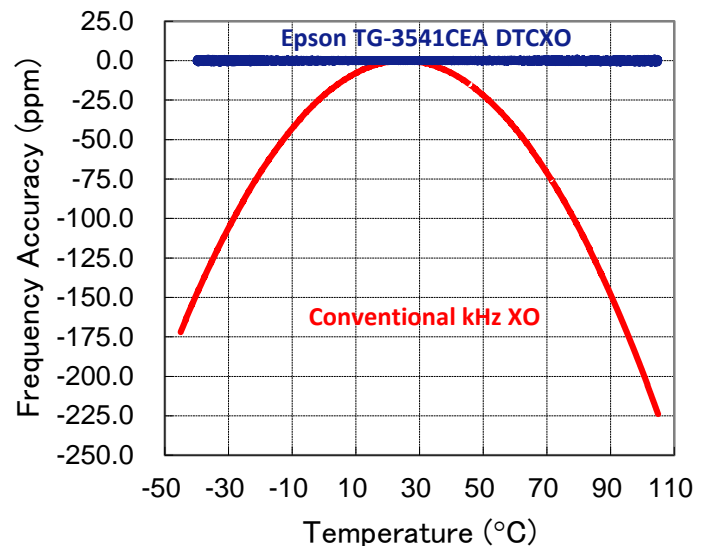
Epson's TG-3541CEA is available in two stability grades.

| Stability Grades |                             |                            |
|------------------|-----------------------------|----------------------------|
| XA               | $\pm 3.4$ ppm -40 to +85 °C | $\pm 8$ ppm +85 to +105 °C |
| XB               | $\pm 5.0$ ppm -40 to +85 °C | $\pm 8$ ppm +85 to +105 °C |

### Automotive Quality

Epson's TG-3541CEA is manufactured on a dedicated automotive line, meets all applicable automotive quality standards, including AEC-Q100 Grade 2, ISO9001, and TS16949. PPAP data is available upon request.

Frequency Accuracy vs. Temperature



Power vs. Temperature

