

nvSRAM FAQs

Section 1. nvSRAM Market

1. What is the Cypress nvSRAM portfolio?

Cypress offers two variants of nvSRAM products.

- a. *nvSRAM without RTC (Real-Time- Clock)*
Parallel – Densities: 16Kbit through 8Mbit,
Serial – Density: 1 Mbit, SPI interface
- b. *nvSRAM with RTC*
Parallel – Densities: 256Kbit, 1Mbit and 4 Mbit.
Serial – Density: 1 Mbit, SPI interface

2. Specify the operating voltage options and temperature grades for these nvSRAMs?

Operating voltage: 3V (Typ.) and 5V (Typ.)

Operating temperature: Commercial (0°C to +70°C) & Industrial (-40 °C to +85 °C).

3. What are different package options available in nvSRAMs?

Cypress offers 8 pin DFN and 16 SOIC package options in serial nvSRAMs. Parallel nvSRAMs are available in multiple package options such as 32 pin SOIC, 44 TSSOP II, 48 FBGA, 48 pin SSOP, and 54 pin TSSOP II packages.

Pin count and package option varies based on nvSRAM density, bus organization and nvSRAM types.

4. What is the available bus organization in parallel nvSRAM?

16Kbit to 256 Kbit density nvSRAMs are available in x8 bus organization. Higher density (1 Mbit and above) nvSRAMs are available in both x8 as well as x16 data bus organization.

5. Why do we need an nvSRAM?

nvSRAM can be used in applications that require fast read and write access times and also requiring the memory to be non-volatile (the information retained even when power is turned off). Memories such as EPROMs,

EEPROMs, and Flash are also non-volatile, but the write and erase times are far too slow for normal system operation. nvSRAM product is advantageous over others since it offers the convenience of SRAM operation with the Non-Volatile features.

6. Does Cypress plan to offer nvSRAM in Die and Wafer form?

Cypress will support KGD (Known Good Die) on its nvSRAM products.

7. Does nvSRAM support automotive grade parts?

Cypress nvSRAM are under process of automotive qualification upto +125 °C. Please contact local Cypress sales and FAEs for availability of automotive grade parts.

8. What are key applications of nvSRAM?

nvSRAM is a perfect fit for applications requiring high speed, nonvolatile memory. Its ease of insertion makes it a natural choice where batteries and other nonstandard packaging concerns rule out other technologies. Its high speed allows it to operate where other technologies (BBSRAM, Flash, EEPROM) can't, such as embedded DSP and other fast processor applications. It provides secure data retention such as found in military, financial, and gaming industries because of long data retention times. Ex: Digital Oscilloscopes, Hubs and Routers, Gaming, Servers, RAID (Redundant Array of Independent Drives), PLCs and POS

Section 2. nvSRAM Device

9. Explain the terminologies nvSRAM and BBSRAM?

nvSRAM: nvSRAM is an acronym for Non Volatile Static Random Access Memory. nvSRAMs integrate SRAM and EEPROM technologies on the same chip (Monolithic solution). They provide a high speed memory operation of upto 20ns for parallel devices and 40 MHz in SPI. During power down, data is stored into EEPROM in parallel from high speed SRAM, resulting in data to be retained even when the power is switched off

BBSRAM: BBSRAM is an acronym for Battery Backed-Up SRAM. It features a small coin battery (made of Lithium) in the SRAM package. BBSRAM use Low Power Asynchronous SRAM, and hence the performance of a BBSRAM device normally available at a max. speed of 70ns is slower compared to nvSRAMs operating at 25ns.

10. Explain the terminologies Data Retention and Endurance?

Data retention:

Data retention is a measure of how long the data will be safely saved in the non-volatile cells. nvSRAM will retain data for at least 20 years at operating temperature, after each STORE. Retention is measured from the time of the most recent STORE

Endurance:

Endurance is a measure of the number of times the SRAM data can be stored into nonvolatile memory before the cell wears out. In the nvSRAM, the user performs writes to the SRAM portion of chip, which has no wear out problem, and can be accessed unlimited number of times. STORE operation is normally conducted only on Power Down. During STORE operation the EEPROM memory cells are used and these have a 1 Million cycle guaranteed endurance

11. How is nvSRAM Read/Write operation performed?

Read/Write operation in nvSRAM is performed on the SRAM during power supply is on. At power down, the contents of SRAM are copied into non volatile EEPROM cell of nvSRAM immediately in order to prevent data loss, and no access is allowed with SRAM at this time. The copied data is later recovered from EEPROM into SRAM during power-up.

12. Explain the AutoStore, Hardware STORE and Software STORE operations in nvSRAM?

When the system V_{CC} drops below V_{SWITCH} (typically 2.65V for 3V parts and 4.4V for 5V parts), the entire SRAM array is stored in parallel into EEPROM within time duration of less than 8 milliseconds.

If the HSB# (Hardware Store Busy) pin in nvSRAM is asserted low, a STORE operation will be initiated immediately after completing the current cycle. This is called a Hardware STORE operation.

In case of Software STORE operation, the STORE operation is initiated by reading a specific sequence of six addresses in order, with no intervening access to other locations.

The nvSRAM is unavailable for the normal access during STORE cycle initiated by any of the three means.

13. Explain RECALL operation in nvSRAM?

A RECALL operation in nvSRAM copies data from EEPROM to SRAM, in parallel. All nvSRAMs automatically RECALL stored data on power-up

14. Does Cypress nvSRAM have an external battery to source power at power failure?

Cypress nvSRAMs don't require any external battery. Instead it uses an external capacitor as backup power source which is utilized for the data backup into EEPROM from SRAM during the situation of power loss. The charge present on the capacitor is sufficient to get all the data transferred into EEPROM safely. Using a capacitor has the obvious advantage of recharging the backup source each time the system is powered up.

15. What is RTC and where is it used?

A RTC device is one that maintains a digital image of the Time-Of-Day (TOD) or calendar. It is used in applications such as POS (Point-Of-Sale) terminal, server applications etc. where the critical information is saved with time-tagging.

16. What is the crystal frequency on nvSRAM with RTC feature and minimum capacitor rating for RTC backup?

The frequency of oscillation of an external crystal which used in nvSRAMs RTC is 32.768-kHz. The backup capacitor rating to run RTC in the absence of Vcc power depends on the total hours of backup time needed in an application. The value of Capacitance varies from 0.1F for 72 hours, 0.47F for 14 days and 1F for 30 days of back-up duration. To avail RTC back up for greater than 30 days, a coin cell battery if preferred instead of a bigger capacitor. A fully charged 48 mAh Lithium battery can backup nvSRAM RTC upto 10 years without re-charging it.

17. What happens if a Power Fluctuation occurs?

Whenever there is a fluctuation in Vcc power supply, the data from SRAM are immediately transferred into EEPROM by means of the power supplied by external capacitor, provided there is at least ONE Write operation happened successfully before power down. This is to ensure that the endurance of EEPROM is unaffected due to frequent writes to EEPROM at each power fluctuation.

18. What is the accuracy of RTC clock?

The RTC is driven by a quartz-controlled oscillator with a nominal frequency of 32.768 kHz. Clock accuracy will depend on the quality of the crystal, usually specified to 35 ppm limits at 25°C. This error could equate to +1.53 minutes per month. Cypress RTC nvSRAMs employ an on-chip software calibration circuit that can improve the accuracy to +1/-2 ppm at 25°C.

19. Do nvSRAM have a clock signal?

nvSRAM do not have a clock signal since they operate as standard fast Asynchronous which doesn't require a clock signal to perform Read/Write function

Section 3. Comparison with Alternate Technologies

20. Can nvSRAMs replace Flash memories?

nvSRAM can replace the function of Flash memories. But they are not a drop-in replacement

21. List some of the benefits of nvSRAM over BBSRAM, EEPROM and Flash memories.

Benefits of nvSRAM over BBSRAM

- nvSRAMs have 20 years of data retention whereas certain BBSRAMs can have retention times of upto 5 years
- They do not contain batteries to fail hence 100% RoHS compliant
- No battery disposal hazard
- There is no data loss from electrical noise or undershoot
- They provide faster Read/Write capability
- No Socketing or "snap on" assembly steps
- nvSRAM package solders directly onto PC board. They use standard SMD soldering techniques and do not require additional manufacturing steps

Benefits of nvSRAM over EEPROM

- Offer very high speed memory operation of upto 25ns
- Eliminates EEPROM write limitations
- Symmetrical Read/Write accesses to 25ns
- They do not take additional system time for STORE operation as it is done only on Power Down.

Benefits of nvSRAM over Flash memory

- Easy and Fast data storage
- All program and data changes saved in a single STORE cycle under user control or on power-down
- Quick program storage, data storage and SRAM functionality all available in single package

22. What are the advantages of nvSRAM over Low-Power Asynchronous SRAM?

- nvSRAM devices are non-volatile meaning data is not lost because of power down unlike SRAM which tend to lose data (volatile device)
- nvSRAM has access time as fast as 20ns, whereas the fastest low-power Asynchronous SRAMs are offered in 35ns speed.
- Async. SRAM and a battery used as discrete components in a single package to make a BBSRAM. This implementation has the problem in biasing the SRAM in Standby mode to keep the power drain low. nvSRAMs are considered to be superior to Async. SRAMs as they eliminate battery requirement to achieve non-volatile features, at the same time nvSRAM supports faster access speed as compared to low power SRAMs.