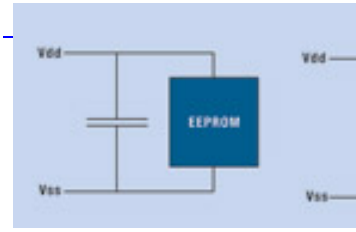
F-RAM Moves to Automotive Infotainment Applications

Protecting infotainment dynamic data is essential. The unique advantage of F-RAM guarantees higher availability & performance.

By Duncan Bennett, Ramtron International

The use of non-volatile ferroelectric RAM (F-RAM) in automotive applications began with airbag applications. This type of safety critical application was



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particularly well suited to F-RAM's high endurance. In recent years, designers of Infotainment equipment have started to specify F-RAM as they have seen the benefits of this now mature AEC Q100 qualified non-volatile memory technology.Protecting infotainment dynamic data is essential.

Below are some specific examples of how F-RAM is used and the problems it solves. To begin, it is useful to compare the difference between F-RAM and EEPROM (the common choice for automotive Infotainment applications).

Standard Techniques

One of the problems facing the designers of all electronic systems in a vehicle is the sudden loss of power. This typically happens when the engine is started and can also happen any time the driver stalls the engine.

There are a couple of standard circuit techniques where F-RAM is used. The first is to replace an EEPPROM + capacitor combination. The F-RAM uses much less power and writes much quicker so there is no need for a capacitor to keep the power alive while writing is completed during a power-loss scenario. The two circuits below are essentially equivalent. The capacitor can be large due to the power requirements of the EEEPORM during writing.

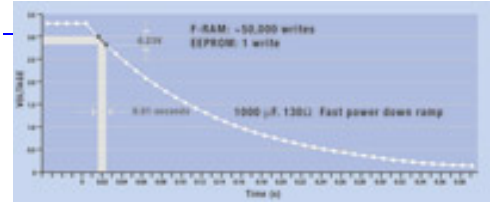
The second common technique to use F-RAM is where data must be stored on power loss. The graph shows a typical RC decay curve (see Figure 2.) The microcontroller sees the power starting to fail at 3.1 V and has until Vdd reaches 2.8 V before the brown-out detector fires the reset of the microcontroller and prevent

further writing. In the example shown in Figure 2, the microcontroller only has 10 mS between these 2 points — just enough to write 1 byte or maybe 1 page of data to an EEPROM. In the same timeframe, it is possible to complete 50,000 writes to an SPI F-RAM.

Application Examples

Here are some application examples in the automotive infotainment market segment.

*Car Radio —*Many of the new format radios are handling a lot of data in addition to the normal audio channels. This data could be something as simple as traffic information or weather information. One of the desirable requirements is for this information to be available as soon as the driver enters the car. After all, it's better to have the traffic information before starting a journey, rather than 10 minutes into a journey when the driving route options have become more limited.



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This requirement means that radios have to download traffic information when the car engine is switched off. In these conditions, the vehicle manufacturer is placing ever more stringent requirements on the amount of power that may be drawn from the battery. In addition, the radio has no way of knowing when the driver will return to the vehicle so it must be downloading and storing the data continuously. F-RAM suits this application because it can be written as many times as desired with no practical limitation on endurance, allowing the traffic information to be written to the F-RAM whenever it is available. After writing, the radio can enter a lower power state waiting for the next wake up. In addition, the power required to write to F-RAM is considerably lower than EEPROM further reducing the overall power budget. Using EEPROM in this application would not be possible because it does not have a high enough endurance and it would consume too much power when writing.

Navigation Systems

Navigation systems are one of the fastest growing areas of the infotainment market and at the same time one of the fastest changing.

F-RAM has found a number of uses in navigation systems. If the system relies on a DVD for mapping information, then the F-RAM can be used to record the position of the DVD reading head. This allows the reading to be continued quickly in the event of a sudden power loss on (typically on engine start).

A similar problem is when the navigation system loses sight of enough satellites to be able to make a firm position fix (typically on entering a tunnel). If the position is always stored in F-RAM, then the navigation system can always use the F-RAM

based position until a new satellite position fix can be acquired. This has the advantage of the position being available in the event of a sudden power loss. This type of continuous writing is a common technique when using F-RAM.

One of the most exciting prospects for navigation systems is the ability to access localized Points-of-Interest. Recently Microsoft® bought a small stake in Facebook valuing the company at $15B at the time. So what makes Facebook so valuable? The answer is targeted advertising. All of the people using Facebook enter personal information. This information will be mined to allow Facebook to sell advertising to exactly the right people. A similar situation exists with navigation systems. The ability to advertise a restaurant at just the right time in the journey is very valuable. Imagine a navigation system prompting the driver and the vehicle's passengers with the latest offers just minutes away.

All of this dynamic data has to be stored somewhere and again F-RAMs high endurance allows the data to be written continuously.

Another future development with navigation systems is the use of localized data. With the growth of electronic stability control it is possible for a vehicle to discover an icy part of the road, send this information to the navigation system that could in turn notify a server. Other navigation systems could be interrogating this server and be warned in advance of the conditions.

USB Connectors

USB and Bluetooth® connectivity is coming to vehicles. These will probably be standard interfaces in the near future.

The USB connector allows the vehicle to take advantage of the revolution that has happened in the music industry. People no longer buy music on CDs, they just download their choice of song to their iPod® or other portable player. A USB connector allows the vehicle to access this portable music collection that millions of us carry around everywhere.

The USB interface must recognize the different devices and the different types of music (or video) that are present. It must be able to keep track of play lists for different devices as we switch from mp3 player to USB stick. It must remember the last play point for each different device and even for each different play list in each different device. All of this dynamic data needs to be held somewhere; and it must

be non-volatile so that the music continues at exactly the same place when returning to the vehicle after stopping for fuel or even overnight. F-RAMs high endurance is ideal for these applications once again.

DVD Players

Finally, F-RAM has a unique relationship with DVD players. F-RAM can be used to record the position of the reading head so that in the event of a sudden power loss (e.g. vehicle engine is stalled), the DVD player can quickly resume from the last known position.

This is an essential feature, as every parent will confess. Kids watching a DVD in the backseat will have harsh criticism for any driver who accidentally causes their favorite DVD to be interrupted by a power loss when the engine has to be restarted. Anger will turn to rage when the DVD resumes play — from the beginning track!

The above scenario is eliminated in DVD systems with F-RAM, which continuously writes the position of the head to memory, making use of F-RAMs virtually unlimited endurance and fast write ability.

Non-volatile Ferroelectric RAM: Ideal for Infotainment

Dynamic data is a fundamental component of many automotive infotainment systems and protecting this data is essential. The unique advantages of F-RAM — fast writes, virtually unlimited endurance, and low-power — allow designers to guarantee that infotainment dynamic data has higher availability and greater integrity.

Duncan Bennett is a marketing manager at Ramtron International.

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