Upgrade to National's Wide Voltage Range, Zero Standby Current EEPROMs

National Semiconductor
Application Note 870
Paul Bryant
July 1996

ABSTRACT

National's NM93C06L, NM93C46L, NM93C56L and NM93C66L EEPROMs and the new NM93C06/46/56/66LZ series devices operate across a 2.7V to 5.5V range suitable for unregulated battery powered operation. In addition, the new NM93C06/46/56/66LZ devices have ultra-low standby currents ideal for portable applications using very small batteries.

PERSONAL ELECTRONICS GAIN SOPHISTICATION

Many personal electronic items have moved from being perceived as trendy novelties to being viewed as mainstream personal or business appliances. Consumer familiarity, in turn, produces sophistication in the market for features. The ability to retain memory through battery changes and other types of power failure is highly desirable. Implementation of such sophisticated features requires RAM with battery back up or EEPROM memory.

Battery backed up RAM is usually far more expensive and functionally less attractive than EEPROM memory. Battery backed up RAM requires:

1. RAM
2. Battery holder
3. Battery
4. A door or other method to allow the battery to be replaced
5. New batteries to be located and replaced by the owner

EEPROM on the other hand requires:

1. EEPROM.

Serial EEPROM is invariably the cheapest and most compact solution for memory requirements up to 16 kbits.

CORDLESS PHONES

Memory dialing, noise reduction signal processing, and multi-channel operation with low noise channel selection capability, are now standard features for better quality cordless phones. Cordless phones are now moving to serial EEPROMs which can retain memory dial phone numbers and other parameters even through the inevitable dead battery and line power outage events.

Cordless phones have limited battery life. Memory dial data and other feature settings stored in RAM are subject to loss from dead batteries if implemented in the hand unit, or line power outages if maintained in the base unit. Reprogramming ten or more numbers for a memory dialer each time this happens is not desirable. Implementation of memory dialing and other features in the environment of a cordless phone requires RAM with a battery back up or EEPROM memory.

The length of time a phone can be left off its charger when not in use without the battery going dead is called standby. The cordless phone in standby normally leaves the radio receiver on to listen for incoming calls so that it can ring locally.

Standby and off hook time power consumption are dominated by the linear circuitry of the radio transmitter and receiver. Furthermore, the batteries in this application are relatively large and are frequently recharged. Thus, this application does not usually require the extremely low standby currents that can be achieved with the ''LZ'' series serial EEPROMs. But a broad range of V_{CC} voltages are encountered in this application. Most cordless phones use a stack of three Ni-Cad batteries for power. This produces a nominal voltage of 3.6V, but during charging this may go as high as 4.0V, and may drop into the 2.7V range in use. Some types of cordless phones use other battery technologies and battery counts. For example, stacks of 2 lead acid cells are also used producing a 4V nominal V_{CC}. The 2.7V to 5.5V V_{CC} range allowed by the ''L'' series of serial EEPROMs accommodates all the common V_{CC} ranges.

PAGERS

Paging units are a second example of high technology electronics gone blasé. Unlike cordless phones, pagers use regulated batteries for power and thus, do not need wide V_{CC} range EEPROMs. Since the batteries are small and power is a concern, low voltage operation is an advantage, as are very low standby currents used by the ''LZ'' series.

ELECTRONIC CAMERAS

All electronic cameras also make use of the NM93C46LZ and NM93C56LZ devices. This application generally uses regulated batteries to guarantee a constant 5V. But the batteries tend to be small and the camera spends much of its life on the shelf. Parameters stored in the electronic memory on these new cameras include shutter speed and focus calibrations that must never be lost in the life of the camera, and the frame counts and other details that change in service but which must not be lost when the battery dies.

The parameters connected with the many features found on these cameras are best retained in EEPROM. The small batteries and the long periods of inactivity involved require an EEPROM with very low standby currents to avoid running down the battery when not in use. With a standby current of less than 1 μA, the ''LZ'' series parts handle these applications with ease.

LEARNING REMOTE CONTROL UNITS

Alas, you have taught your new remote control unit to control the volume on your TV, it has mastered the slow advance on the video cassette recorder, it turns on and off the CD player, and your local soap opera is recorded daily

thanks to VCR Plus™ function. If the designer hasn't stored the critical information required in an EEPROM, one had better hope the battery never dies, or one will again become a slave to his ''personal assistant'' while retraining the beast. Owners of many first generation VCRs and televisions with digital random access tuners know the feeling well. Random access tuners allow their owners to skip over all the channels that could not be accessed in the area or that the owner simply did not like. But, if the power cord was even briefly disturbed or if the power went down, the tuner had to be retrained, a time consuming operation.

Both learning remote controls and digital tuners are more likely now to cure these problems by using EEPROM. TV and VCRs do not need low voltage, wide V_{CC} range, or low standby current parts, but the remote control units frequently do. The scenario is familiar:

1. Unregulated batteries are used.
2. The batteries are not large or frequently recharged.
3. The units spend relatively little time actually in use.
4. Long battery life is desirable.

Smart remote controls benefit from the wide V_{CC} range and low standby characteristics of the NM93C46LZ and NM93C56LZ serial EEPROMs.

SUMMARY

Serial EEPROMs offer by far the most compact and low cost non-volatile memory solutions for common consumer applications. The need for serial EEPROMs continues to grow with increasing consumer sophistication and growth of the personal electronics market. National's LZ products have wide operating voltage ranges and very low standby power and are particularly appropriate for battery powered applications of all types.

National Semiconductor Corporation
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

http://www.national.com

National Semiconductor Europe
Fax: +49 (0) 180-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 180-530 85 85
English Tel: +49 (0) 180-532 78 32
Français Tel: +49 (0) 180-532 93 58
Italiano Tel: +49 (0) 180-534 16 80

National Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
Tel: 81-043-299-2308
Fax: 81-043-299-2408