

# eSD (Embedded SD)

## Industrial SD card in Surface Mount Package

The eSD (embedded SD) is a BGA memory chip with standard SD interface. The eSD incorporates industrial grade wide-temp 2D SLC NAND and its high endurance and strong data retention makes it ideal for demanding applications where conventional MLC/TLC-based eMMC/UFS fail.



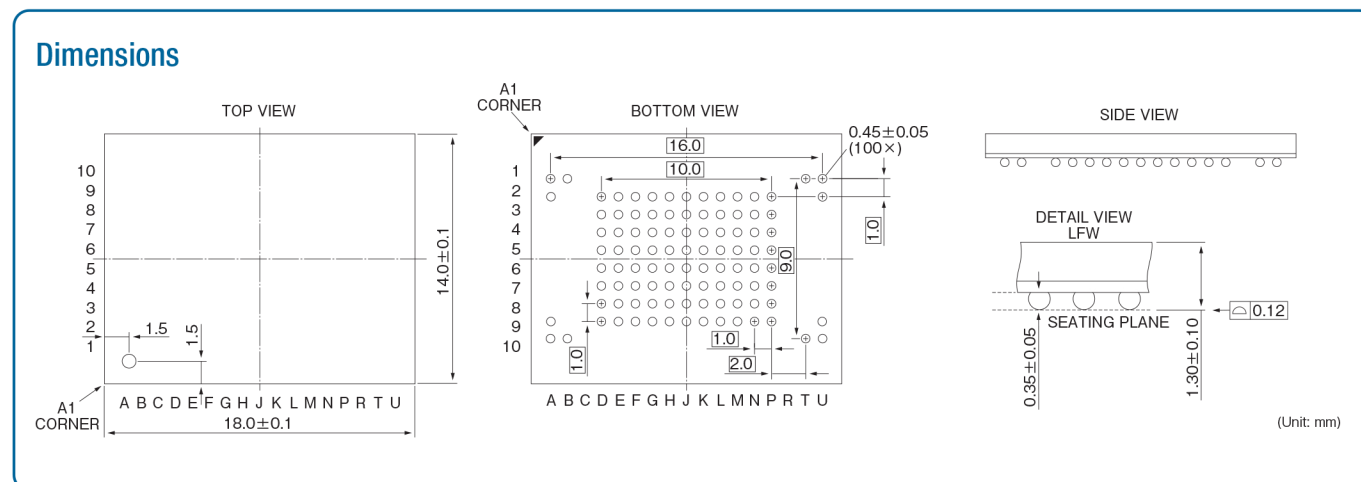
|                        |   |   |
|------------------------|---|---|
| Package                | JEDEC 100-Ball BGA, 1.0mm Ball Pitch                    |   |
| Host Interface         | SD Physical Layer Specification Ver.3.01 compliant      |   |
| NAND / Capacity        | SLC (1GB / 2GB / 4GB / 8GB / 16GB)                      |   |
| Guaranteed P/E cycle   | 1GB & 2GB: 50,000 per block / 4~16GB: 100,000 per block |   |
| Bus Speed Mode         | 1 GB to 16 GB   |   |
|                        | Default speed mode (DS)                                 | 3.3V signaling, Frequency up to 25MHz, Speed up to 12.5MB/s |
|                        | High speed mode (HS)                                    | 3.3V signaling, Frequency up to 50MHz, Speed up to 25MB/s   |
|                        | 4 GB to 16 GB   |   |
|                        | SDR12   | 1.8V signaling, Frequency up to 25MHz, Speed up to 12.5MB/s |
|                        | SDR25   | 1.8V signaling, Frequency up to 50MHz, Speed up to 25MB/s   |
| Operating Voltage      | 2.7 V to 3.6 V  |   |
|                        | Operating Temperature                                   | -40°C to 85°C   |
|                        | Other   | Drive life management based on internal attributes          |
|                        |   | Read disturb management                                     |
| Wear-leveling          |   |   |
| Power loss protection  |   |   |
| BGA to SD socket board |   |   |



SLC

Static Wear Leveling Refresh Patrol Function Read Retry Power Loss Alert Fixed BOM TCG Opal 2.0 S.M.A.R.T. Life Indicator LED DevSleep Wide Temperature Power Loss Recovery Live Monitor Live Drive Monitor Thermal Sensor RoHS Compliant Article Information Sheet

● Default ○ Optional



## Standard SD Card Interface

eSD is SDA standardized and the well-known SD interface is supported by various micro processors. It allows embedded devices to utilize the same common interface without requiring a special controller.

## Robust SLC NAND

eSD incorporates 2D SLC NAND flash that provides excellent reliability and endurance over MLC/TLC-based eMMC.

## 1.0mm Ball Pitch

The 1.00mm pitch eliminates the need for special design practice like Pad-on-Via and allows for lower PCB design & manufacturing costs.

## In-House SSD Controller Design

The reliability of flash storage largely relies on the NAND type and the flash management capability of the flash controller. The eSD incorporates the Hagiwara original SD controller which have proven reliability with a track record in industrial applications.

## Hagiwara original Active Refresh function

Read-disturb management is critical when storing read-centric applications such as boot code, OS kernel. The eSD incorporates active refresh which proactively prevents read error by monitoring read count.

## eSD Life Diagnostics Tool

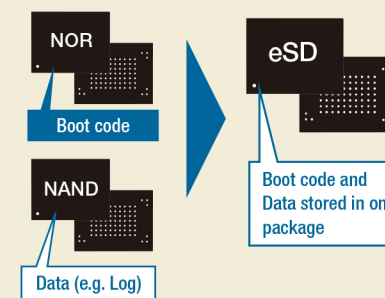
The eSD life-monitoring & diagnostic tools allow users to gather essential information such as program/erase cycle and remaining spare block information. By gathering this data, the tool helps determine optimal timing for preventive and predictive maintenance.

- Life Assessment Software (Windows)
- API (Windows/Linux)
- Commands required for the life assessment



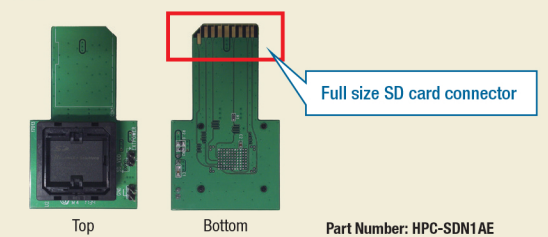
## Robust Alternative to NOR

The eSD eliminates the need for having separate components for boot code and data storage and saves board real estate and manufacturing costs. Built-in 2D SLC NAND delivers excellent data-retention compared to MLC/TLC NAND.



## eSD Evaluation Adapter Board (Optional)

The adapter allows you to connect eSD chip to standard SD card slot.



## User Scenarios

| Using NOR  | Using NOR + NAND  | Using eMMC  | Considering SD card for a new design  |  |
|--|---|---|---|--|
| <b>Challenge</b>   | <b>Challenge</b>  | <b>Challenge</b>  | <b>Challenge</b>  | <b>Challenge</b>   |
| Capacity is insufficient to meet increasing data volume. | Increased cost associated with having NOR and NAND flash on board                                   | Concerns on long-term reliability of MLC/TLC                          | Removable media may have unstable connection in a high vibration environment.               | Inserting SD card during production requires additional man-hour.      |
| <b>Solution</b>  | <b>Solution</b>   | <b>Solution</b>   | <b>Solution</b>   | <b>Solution</b>  |
| eSD : 1GB to 16GB<br>NOR : up to 128MB                   | eSD provides ample storage for code and data in a single package while reducing manufacturing cost. | eSD uses 2D SLC NAND that provides high endurance and data retention. | eSD can be soldered directly on the motherboard and provides excellent vibration tolerance. | Surface mount component improves assembly efficiency and reduce costs. |