CMOS IC Application Note

S-82B1B Series Usage Guidelines

Rev.1.0_00

The S-82B1B Series is a protection IC for lithium-ion / lithium polymer rechargeable batteries, which includes high-accuracy voltage detection circuits and delay circuits. It is suitable for protecting 1-cell lithium-ion / lithium polymer rechargeable battery packs from overcharge, overdischarge, and overcurrent. The S-82B1B Series has an input pin for power-saving signal (PS pin), allowing for reduction of current consumption by using an external signal to start the power-saving function.
This application note is a reference describing typical connection examples with notes on power-saving function as well as providing recommended circuit examples for using the S-82B1B Series.

Refer to the datasheet for details and specs of this IC.

Contents

1. Battery Protection IC Connection Example

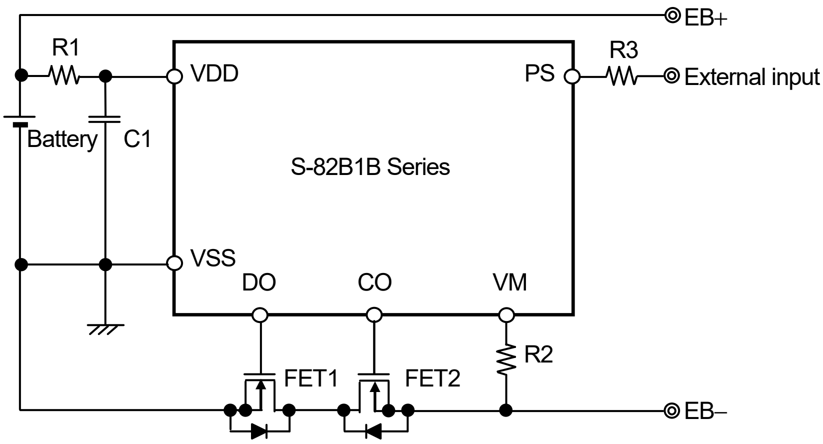


Figure 1

Table 1 Constants for External Components

Symbol	Part	Purpose	Min.	Typ.	Max.	Remark
FET1	N-channel MOS FET	Discharge control	–	–	–	Threshold voltage ≤ Overdischarge detection voltage*1
FET2	N-channel MOS FET	Charge control	–	–	–	Threshold voltage ≤ Overdischarge detection voltage*1
R1	Resistor	ESD protection, For power fluctuation	270 Ω	330 Ω	1.0 kΩ	Caution should be exercised when setting V_{DIOV1} ≤ 30 mV, V_{CIOV} ≥ –30 mV.*2
C1	Capacitor	For power fluctuation	0.068 μF	0.1 μF	1.0 μF	Caution should be exercised when setting V_{DIOV1} ≤ 30 mV, V_{CIOV} ≥ –30 mV.*2
R2	Resistor	ESD protection, Protection for reverse connection of a charger	300 Ω	470 Ω	1.5 kΩ	–
R3	Resistor	PS pin input protection	–	1 kΩ	–	–

***1.** If a FET with a threshold voltage equal to or higher than the overdischarge detection voltage is used, discharging may be stopped before overdischarge is detected.

***2.** When setting V_{DIOV1} ≤ 30 mV, V_{CIOV} ≥ –30 mV for power fluctuation protection, the condition of R1 × C1 ≥ 100 μF • Ω should be met.

Caution 1. The constants may be changed without notice.

2. It has not been confirmed whether the operation is normal or not in circuits other than the connection example. In addition, the connection example and the constants do not guarantee proper operation. Perform thorough evaluation using the actual application to set the constants.

2. S-82B1B Series Power-saving Function (PS pin control logic active "L")

2. 1 S-82B1B Series power-saving function

When the battery is in the normal status and the PS pin voltage drops below PS pin voltage "L" (V_{PSL}) and stays in that state for the power-saving delay time (t_{PS}) or longer, a discharge control FET is turned off and discharging is stopped. This status is called the discharge inhibition status. Under the discharge inhibition status, S-82B1B Series is internally shorted by the resistance between VDD pin and VM pin (R_{VMD}), and the VM pin is pulled up by R_{VMD} (1 MΩ typ.). When the VM pin voltage becomes V_{DD} – 0.8 V typ. or higher within the overdischarge detection delay time (t_{DL}) after the discharge control FET has been turned off, the IC transitions to the power-saving mode and this condition is latched. Current consumption drops to the level of current consumption during power-saving (I_{PS}).

2. 2 Notes and countermeasures for an actual application

In an actual application, capacitors (C_2, C_3) for ESD protection and noise countermeasures are usually added as shown in **Figure 2**. The capacitance components (C_2 and C_3) may delay the rise of the VM pin voltage, disable the power-saving function and may also cause oscillation as shown in **Figure 3**.
When the PS pin is active and this status continues for t_{PS} + t_{DL} or longer, the power-saving function is activated. However, when the VM pin voltage does not rise above V_{DD} – 0.8 V within t_{DL}, the IC starts to oscillate by repeatedly transitioning to and releasing the power-saving status.
As a countermeasure, a FET and a resistor can be connected beside the PS pin to ensure transition to the power-saving mode. When the load capacitance of peripheral circuits is large, refer to "**3. Recommended Circuit Examples for Large Load Capacitance Case**".

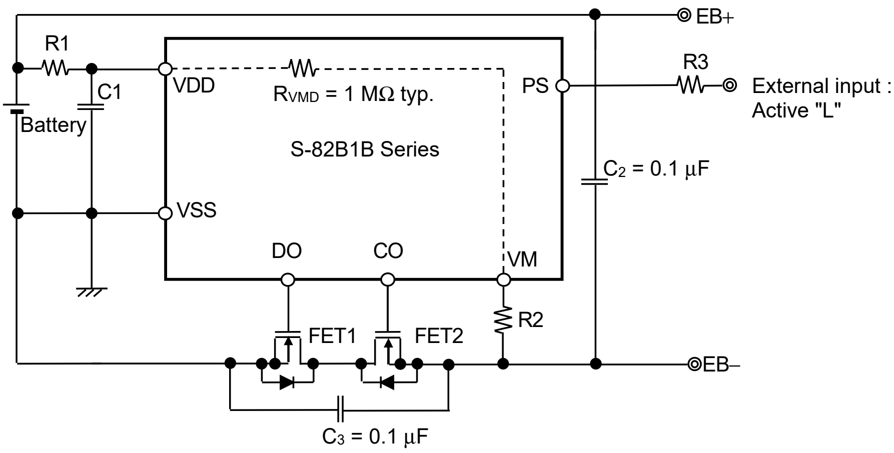
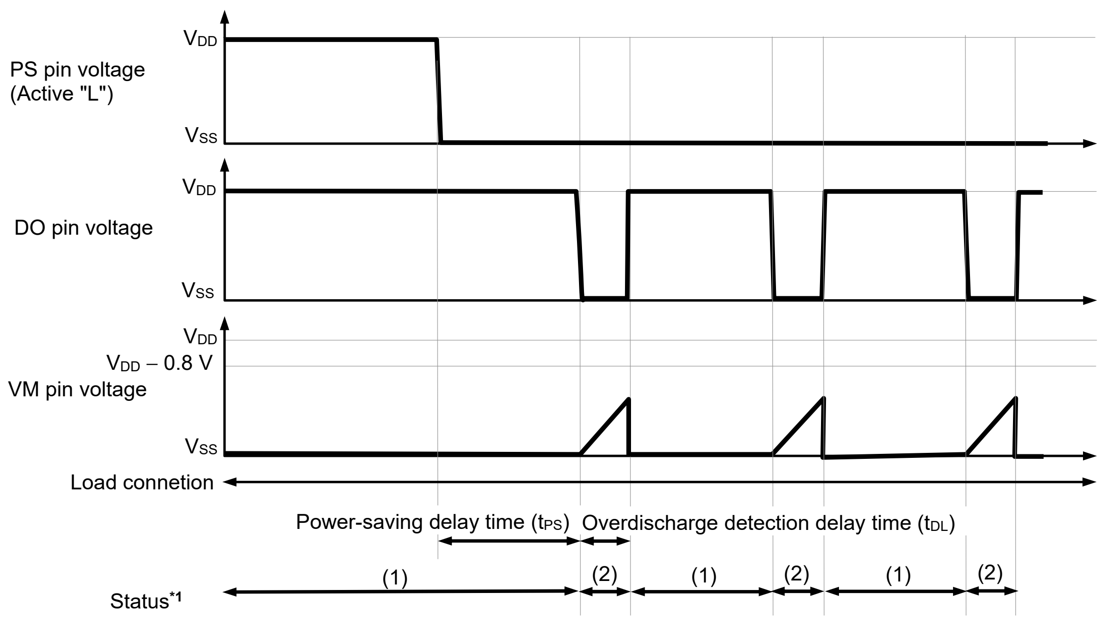


Figure 2



***1.** (1): Normal status
(2): Discharge inhibition status

Figure 3

3. Recommended Circuit Examples for Large Load Capacitance Case

3. 1 Recommended circuit example 1 (PS pin control logic active "L", internal resistor connection "pull-down")

As shown in **Figure 4**, input of the "L" signal to the PS pin or setting it open will enable transitioning to the power-saving mode even with the presence of capacitance components.

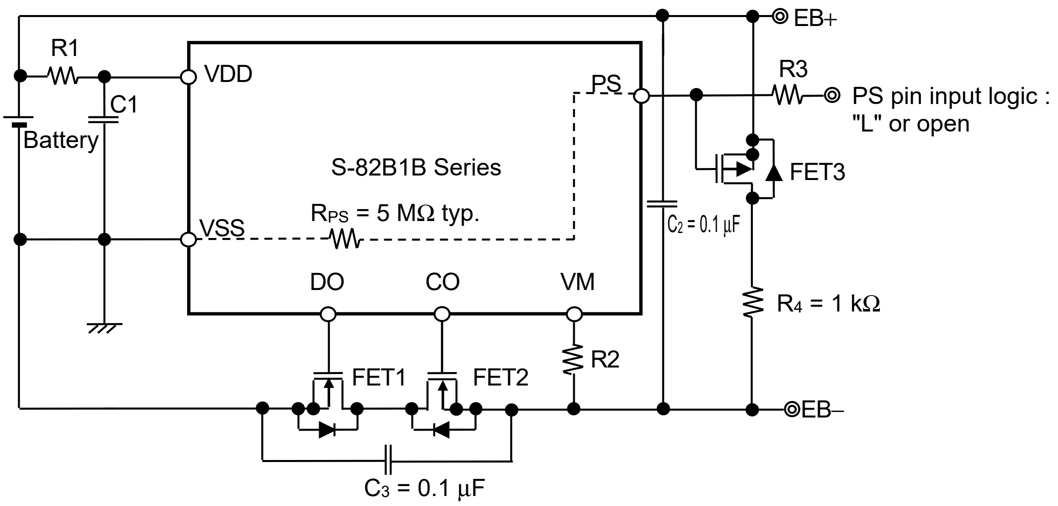


Figure 4

Caution 1. Method for inputting the "L" signal to the PS pin is described below.
- **Input negative potential for battery voltage with reference to V_{DD} (EB+)**
- **Input the "L" signal directly from the V_{SS} of the battery**

2. Do not input signals to the PS pin with reference to EB–. If signals are input, FET1 is turned off during discharge inhibition, causing EB– to enter the floating status, resulting in the loss of the "L" level.

3. 2 Recommended circuit example 2 (PS pin control logic active "L", internal resistor connection "pull-up")

As shown in **Figure 5**, input of the "L" signal to the PS pin will enable transitioning to the power-saving mode even with the presence of capacitance components. When the PS pin is open, it will stay in the normal status.

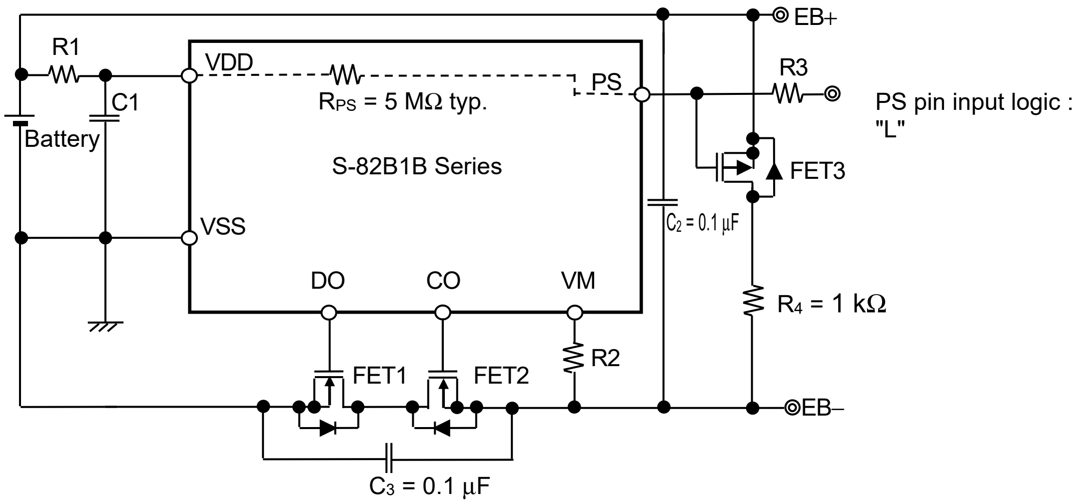


Figure 5

Caution 1. Method for inputting the "L" signal to the PS pin is described below.
• Input negative potential for battery voltage with reference to V_{DD} (EB+)
• Input the "L" signal directly from the V_{SS} of the battery
2. Do not input signals to the PS pin with reference to EB–. If signals are input, FET1 is turned off during discharge inhibition, causing EB– to enter the floating status, resulting in the loss of the "L" level.

3. 3 Recommended circuit example 3 (PS pin control logic active "H", internal resistor connection "pull-down")

As shown in **Figure 6**, input of the "H" signal to the PS pin will enable transitioning to the power-saving mode even with the presence of capacitance components. When the PS pin is open, it will stay in the normal status.

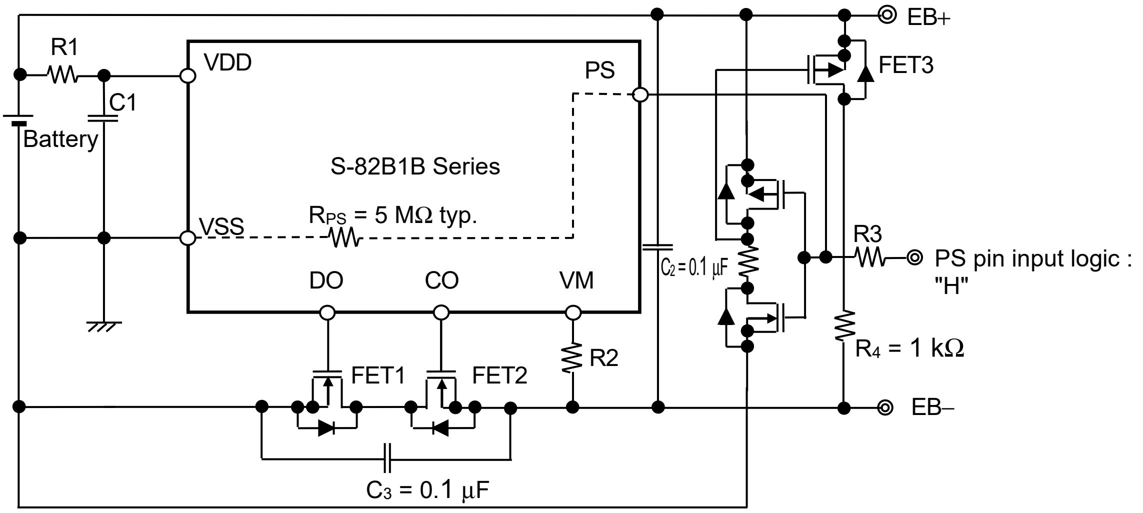


Figure 6

Caution 1. Input the "H" signal directly to the PS pin using V_{DD} (EB+) as reference.

2. Do not input signals to the PS pin with reference to EB–. If signals are input, FET1 is turned off during discharge inhibition, causing EB– to enter the floating status, resulting in the loss of the "L" level.

3. 4 Recommended circuit example 4 (PS pin control logic active "H", internal resistor connection "pull-up")

As shown in **Figure 7**, input of the "H" signal to the PS pin or setting it open will enable transitioning to the power-saving mode even with the presence of capacitance components. The PS pin must remain at "L" level to retain the normal status. Then current will flow through the pull-up resistor (R_{PS}) in the IC from V_{DD} (EB+) to the PS pin, causing a voltage drop in R1, resulting in a minor error in the battery voltage detection.

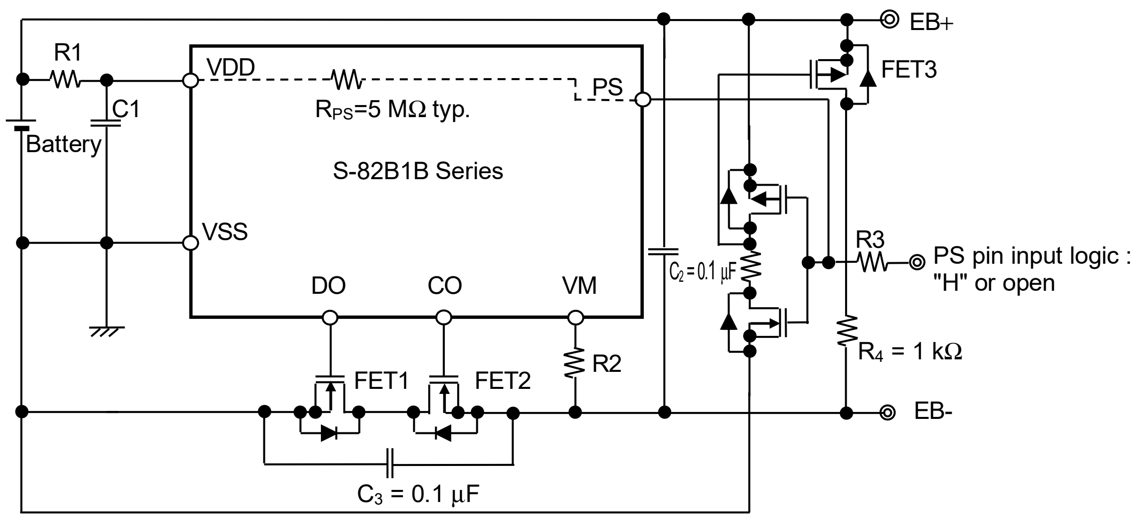


Figure 7

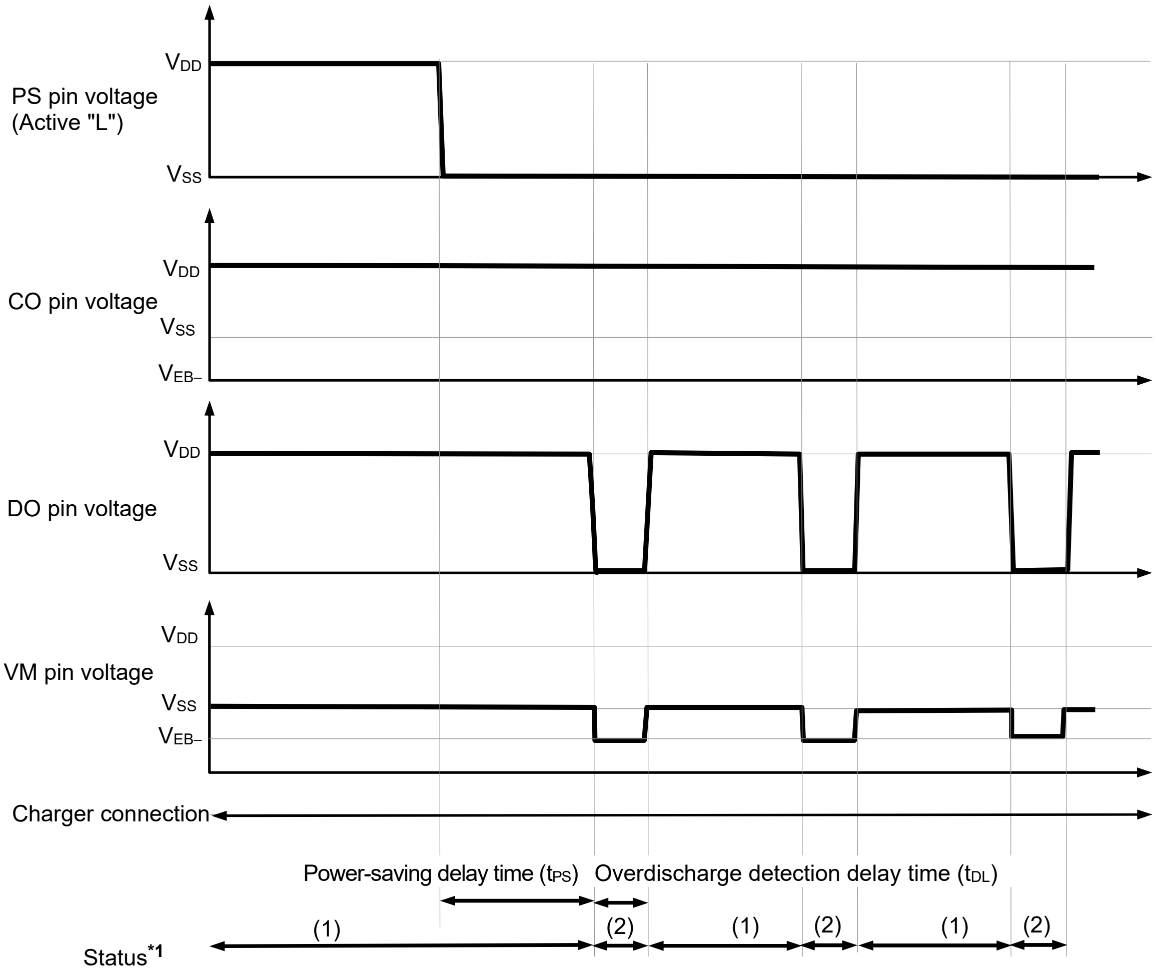
Caution 1. Method for inputting the "L" signal to the PS pin is described below.
- **Input negative potential for battery voltage with reference to V_{DD} (EB+)**
- **Input the "L" signal directly from the V_{SS} of the battery**

2. Do not input signals to the PS pin with reference to EB–. If signals are input, FET1 is turned off during discharge inhibition, causing EB– to enter the floating status, resulting in the loss of the "L" level.

4. Notes on PS Pin Active Status

Do not charge when the PS pin is in active status. If charging is performed in active status, the oscillations shown in **Figure 8** will occur. The CO pin voltage may not reach "L", and overcharge voltage detection may not operate normally.

Take careful note of combination of the PS pin options, including the contents of "**3. Recommended Circuit Example for Large Load Capacitance**".



***1.** (1): Normal status
(2): Discharge inhibition status

Remark The charger is assumed to charge with a constant current.

Figure 8

5. Precautions

- The usage described in this application note is typical example with our IC.
  Perform evaluation fully before use.

- When designing for mass production using an application circuit described herein, the product deviation and temperature characteristics of the external components should be taken into consideration. ABLIC Inc. shall not bear any responsibility for patent infringements related to products using the circuits described herein.

- ABLIC Inc. claims no responsibility for any disputes arising out of or in connection with any infringement by products including this IC of patents owned by a third party.

6. Related Source

Refer to the following datasheet for details of the S-82B1B Series.

S-82B1B Series　Datasheet

The information described in this application note and the datasheet is subject to change without notice.
Contact our sales representatives for details.
Regarding the newest version, select product category and product name on our website, and download the PDF file.

www.ablic.com　　ABLIC Inc. website

Disclaimers (Handling Precautions)

1. All the information described herein (product data, specifications, figures, tables, programs, algorithms and application circuit examples, etc.) is current as of publishing date of this document and is subject to change without notice.
2. The circuit examples and the usages described herein are for reference only, and do not guarantee the success of any specific mass-production design.
   ABLIC Inc. is not liable for any losses, damages, claims or demands caused by the reasons other than the products described herein (hereinafter "the products") or infringement of third-party intellectual property right and any other right due to the use of the information described herein.
3. ABLIC Inc. is not liable for any losses, damages, claims or demands caused by the incorrect information described herein.
4. Be careful to use the products within their ranges described herein. Pay special attention for use to the absolute maximum ratings, operation voltage range and electrical characteristics, etc.
   ABLIC Inc. is not liable for any losses, damages, claims or demands caused by failures and / or accidents, etc. due to the use of the products outside their specified ranges.
5. Before using the products, confirm their applications, and the laws and regulations of the region or country where they are used and verify suitability, safety and other factors for the intended use.
6. When exporting the products, comply with the Foreign Exchange and Foreign Trade Act and all other export-related laws, and follow the required procedures.
7. The products are strictly prohibited from using, providing or exporting for the purposes of the development of weapons of mass destruction or military use. ABLIC Inc. is not liable for any losses, damages, claims or demands caused by any provision or export to the person or entity who intends to develop, manufacture, use or store nuclear, biological or chemical weapons or missiles, or use any other military purposes.
8. The products are not designed to be used as part of any device or equipment that may affect the human body, human life, or assets (such as medical equipment, disaster prevention systems, security systems, combustion control systems, infrastructure control systems, vehicle equipment, traffic systems, in-vehicle equipment, aviation equipment, aerospace equipment, and nuclear-related equipment), excluding when specified for in-vehicle use or other uses by ABLIC, Inc. Do not apply the products to the above listed devices and equipments.
   ABLIC Inc. is not liable for any losses, damages, claims or demands caused by unauthorized or unspecified use of the products.
9. In general, semiconductor products may fail or malfunction with some probability. The user of the products should therefore take responsibility to give thorough consideration to safety design including redundancy, fire spread prevention measures, and malfunction prevention to prevent accidents causing injury or death, fires and social damage, etc. that may ensue from the products' failure or malfunction.
   The entire system in which the products are used must be sufficiently evaluated and judged whether the products are allowed to apply for the system on customer's own responsibility.
10. The products are not designed to be radiation-proof. The necessary radiation measures should be taken in the product design by the customer depending on the intended use.
11. The products do not affect human health under normal use. However, they contain chemical substances and heavy metals and should therefore not be put in the mouth. The fracture surfaces of wafers and chips may be sharp. Be careful when handling these with the bare hands to prevent injuries, etc.
12. When disposing of the products, comply with the laws and ordinances of the country or region where they are used.
13. The information described herein contains copyright information and know-how of ABLIC Inc. The information described herein does not convey any license under any intellectual property rights or any other rights belonging to ABLIC Inc. or a third party. Reproduction or copying of the information from this document or any part of this document described herein for the purpose of disclosing it to a third-party is strictly prohibited without the express permission of ABLIC Inc.
14. For more details on the information described herein or any other questions, please contact ABLIC Inc.'s sales representative.
15. This Disclaimers have been delivered in a text using the Japanese language, which text, despite any translations into the English language and the Chinese language, shall be controlling.

2.4-2019.07