The S-1318 Series, developed by using the CMOS technology, is a positive voltage regulator IC, which features super low current consumption and low dropout voltage. This IC has low current consumption of 95 nA typ. and high-accuracy output voltage of ±1.0%. It is most suitable for use in portable equipment and battery-powered devices.

**Features**

- **Output voltage:** 1.2 V, 1.8 V, 2.2 V, 2.3 V, 2.5 V, 2.8 V, 3.0 V, 3.3 V
- **Input voltage:** 1.7 V to 5.5 V
- **Output voltage accuracy:** ±1.0% (1.2 V output product: ±15 mV) (Ta = +25°C)
- **Dropout voltage:** 45 mV typ. (2.5 V output product, at I_OUT = 10 mA) (Ta = +25°C)
- **Current consumption:**
  - During operation: 95 nA typ.
  - During power-off: 2 nA typ.
- **Output current:** Possible to output 75 mA (1.2 V output product, at V_IN ≥ V_OUT(S) + 1.0 V)\(^1\)
  - Possible to output 100 mA (1.8 V, 2.2 V, 2.3 V, 2.5 V, 2.8 V, 3.0 V, 3.3 V output product, at V_IN ≥ V_OUT(S) + 1.0 V)\(^1\)
- **Input capacitor:** A ceramic capacitor can be used (1.0 μF or more)
- **Output capacitor:** A ceramic capacitor can be used (1.0 μF or more)
- **Built-in overcurrent protection circuit:** Limits overcurrent of output transistor
- **Built-in ON / OFF circuit:** Discharge shunt function "available" / "unavailable" is selectable.
  - Pull-down function "available" / "unavailable" is selectable.
- **Operation temperature range:** Ta = −40°C to +85°C
- **Lead-free (Sn 100%), halogen-free**

\(^1\) Please make sure that the loss of the IC will not exceed the power dissipation when the output current is large.

**Applications**

- Constant-voltage power supply for battery-powered device
- Constant-voltage power supply for portable communication device, digital camera, and digital audio player
- Constant-voltage power supply for home electric appliance

**Packages**

- SOT-23-5
- HSNT-4(1010)
5.5 V INPUT, 100 mA, 95 nA SUPER LOW CURRENT CONSUMPTION VOLTAGE REGULATOR  
S-1318 Series

- Block Diagrams
  1. S-1318 Series A type

```
<table>
<thead>
<tr>
<th>Function</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON / OFF logic</td>
<td>Active &quot;H&quot;</td>
</tr>
<tr>
<td>Discharge shunt function</td>
<td>Available</td>
</tr>
<tr>
<td>Constant current source pull-down</td>
<td>Available</td>
</tr>
</tbody>
</table>
```

*1. Parasitic diode

![Figure 1](image)

2. S-1318 Series B type

```
<table>
<thead>
<tr>
<th>Function</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON / OFF logic</td>
<td>Active &quot;H&quot;</td>
</tr>
<tr>
<td>Discharge shunt function</td>
<td>Available</td>
</tr>
<tr>
<td>Constant current source pull-down</td>
<td>Unavailable</td>
</tr>
</tbody>
</table>
```

*1. Parasitic diode

![Figure 2](image)
3. S-1318 Series C type

![Diagram of S-1318 Series C type](image)

*1. Parasitic diode

<table>
<thead>
<tr>
<th>Function</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON / OFF logic</td>
<td>Active &quot;H&quot;</td>
</tr>
<tr>
<td>Discharge shunt function</td>
<td>Unavailable</td>
</tr>
<tr>
<td>Constant current source pull-down</td>
<td>Available</td>
</tr>
</tbody>
</table>

Figure 3

4. S-1318 Series D type

![Diagram of S-1318 Series D type](image)

*1. Parasitic diode

<table>
<thead>
<tr>
<th>Function</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON / OFF logic</td>
<td>Active &quot;H&quot;</td>
</tr>
<tr>
<td>Discharge shunt function</td>
<td>Unavailable</td>
</tr>
<tr>
<td>Constant current source pull-down</td>
<td>Unavailable</td>
</tr>
</tbody>
</table>

Figure 4
■ Product Name Structure

Users can select product type, output voltage, and package type for the S-1318 Series. Refer to "1. Product name" regarding the contents of product name, "2. Function list of product type" regarding the product type, "3. Packages" regarding the package drawings, "4. Product name list" regarding details of the product name.

1. Product name

S-1318 x xx - xxxx U 4

- Environmental code
  U: Lead-free (Sn 100%), halogen-free

- Package abbreviation and IC packing specifications**1
  MST1: SOT-23-5, Tape
  A4T2: HSNT-4(1010), Tape

- Output voltage**2
  12, 18, 22, 23, 25, 28, 30, 33
  (e.g., when the output voltage is 1.2 V, it is expressed as 12.)

- Product type**3
  A to D

*1. Refer to the tape drawing.

*2. If you request the product which has 0.05 V step, contact our sales office.

*3. Refer to "2. Function list of product types".

2. Function list of product types

<table>
<thead>
<tr>
<th>Product Type</th>
<th>ON / OFF Logic</th>
<th>Discharge Shunt Function</th>
<th>Constant Current Source Pull-down</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Active &quot;H&quot;</td>
<td>Available</td>
<td>Available</td>
</tr>
<tr>
<td>B</td>
<td>Active &quot;H&quot;</td>
<td>Available</td>
<td>Unavailable</td>
</tr>
<tr>
<td>C</td>
<td>Active &quot;H&quot;</td>
<td>Unavailable</td>
<td>Available</td>
</tr>
<tr>
<td>D</td>
<td>Active &quot;H&quot;</td>
<td>Unavailable</td>
<td>Unavailable</td>
</tr>
</tbody>
</table>

3. Packages

<table>
<thead>
<tr>
<th>Package Name</th>
<th>Dimension</th>
<th>Tape</th>
<th>Reel</th>
<th>Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOT-23-5</td>
<td>MP005-A-P-SD</td>
<td>MP005-A-C-SD</td>
<td>MP005-A-R-SD</td>
<td>–</td>
</tr>
</tbody>
</table>

ABLIC Inc.
4. Product name list

4.1 S-1318 Series A type

ON / OFF logic: Active "H"
Discharge shunt function: Available
Constant current source pull-down: Available

<table>
<thead>
<tr>
<th>Output Voltage</th>
<th>SOT-23-5</th>
<th>HSNT-4(1010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 V ± 15 mV</td>
<td>S-1318A12-M5T1U4</td>
<td>S-1318A12-A4T2U4</td>
</tr>
<tr>
<td>1.8 V ± 1.0%</td>
<td>S-1318A18-M5T1U4</td>
<td>S-1318A18-A4T2U4</td>
</tr>
<tr>
<td>2.2 V ± 1.0%</td>
<td>S-1318A22-M5T1U4</td>
<td>S-1318A22-A4T2U4</td>
</tr>
<tr>
<td>2.3 V ± 1.0%</td>
<td>S-1318A23-M5T1U4</td>
<td>S-1318A23-A4T2U4</td>
</tr>
<tr>
<td>2.5 V ± 1.0%</td>
<td>S-1318A25-M5T1U4</td>
<td>S-1318A25-A4T2U4</td>
</tr>
<tr>
<td>2.8 V ± 1.0%</td>
<td>S-1318A28-M5T1U4</td>
<td>S-1318A28-A4T2U4</td>
</tr>
<tr>
<td>3.0 V ± 1.0%</td>
<td>S-1318A30-M5T1U4</td>
<td>S-1318A30-A4T2U4</td>
</tr>
<tr>
<td>3.3 V ± 1.0%</td>
<td>S-1318A33-M5T1U4</td>
<td>S-1318A33-A4T2U4</td>
</tr>
</tbody>
</table>

Remark Please contact our sales office for products with specifications other than the above.

4.2 S-1318 Series B type

ON / OFF logic: Active "H"
Discharge shunt function: Available
Constant current source pull-down: Unavailable

<table>
<thead>
<tr>
<th>Output Voltage</th>
<th>SOT-23-5</th>
<th>HSNT-4(1010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 V ± 15 mV</td>
<td>S-1318B12-M5T1U4</td>
<td>S-1318B12-A4T2U4</td>
</tr>
<tr>
<td>1.8 V ± 1.0%</td>
<td>S-1318B18-M5T1U4</td>
<td>S-1318B18-A4T2U4</td>
</tr>
<tr>
<td>2.2 V ± 1.0%</td>
<td>S-1318B22-M5T1U4</td>
<td>S-1318B22-A4T2U4</td>
</tr>
<tr>
<td>2.3 V ± 1.0%</td>
<td>S-1318B23-M5T1U4</td>
<td>S-1318B23-A4T2U4</td>
</tr>
<tr>
<td>2.5 V ± 1.0%</td>
<td>S-1318B25-M5T1U4</td>
<td>S-1318B25-A4T2U4</td>
</tr>
<tr>
<td>2.8 V ± 1.0%</td>
<td>S-1318B28-M5T1U4</td>
<td>S-1318B28-A4T2U4</td>
</tr>
<tr>
<td>3.0 V ± 1.0%</td>
<td>S-1318B30-M5T1U4</td>
<td>S-1318B30-A4T2U4</td>
</tr>
<tr>
<td>3.3 V ± 1.0%</td>
<td>S-1318B33-M5T1U4</td>
<td>S-1318B33-A4T2U4</td>
</tr>
</tbody>
</table>

Remark Please contact our sales office for products with specifications other than the above.
4.3 S-1318 Series C type

<table>
<thead>
<tr>
<th>Output Voltage</th>
<th>SOT-23-5</th>
<th>HSNT-4(1010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 V ± 15 mV</td>
<td>S-1318C12-M5T1U4</td>
<td>S-1318C12-A4T2U4</td>
</tr>
<tr>
<td>1.8 V ± 1.0%</td>
<td>S-1318C18-M5T1U4</td>
<td>S-1318C18-A4T2U4</td>
</tr>
<tr>
<td>2.2 V ± 1.0%</td>
<td>S-1318C22-M5T1U4</td>
<td>S-1318C22-A4T2U4</td>
</tr>
<tr>
<td>2.3 V ± 1.0%</td>
<td>S-1318C23-M5T1U4</td>
<td>S-1318C23-A4T2U4</td>
</tr>
<tr>
<td>2.5 V ± 1.0%</td>
<td>S-1318C25-M5T1U4</td>
<td>S-1318C25-A4T2U4</td>
</tr>
<tr>
<td>2.8 V ± 1.0%</td>
<td>S-1318C28-M5T1U4</td>
<td>S-1318C28-A4T2U4</td>
</tr>
<tr>
<td>3.0 V ± 1.0%</td>
<td>S-1318C30-M5T1U4</td>
<td>S-1318C30-A4T2U4</td>
</tr>
<tr>
<td>3.3 V ± 1.0%</td>
<td>S-1318C33-M5T1U4</td>
<td>S-1318C33-A4T2U4</td>
</tr>
</tbody>
</table>

Remark Please contact our sales office for products with specifications other than the above.

4.4 S-1318 Series D type

<table>
<thead>
<tr>
<th>Output Voltage</th>
<th>SOT-23-5</th>
<th>HSNT-4(1010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 V ± 15 mV</td>
<td>S-1318D12-M5T1U4</td>
<td>S-1318D12-A4T2U4</td>
</tr>
<tr>
<td>1.8 V ± 1.0%</td>
<td>S-1318D18-M5T1U4</td>
<td>S-1318D18-A4T2U4</td>
</tr>
<tr>
<td>2.2 V ± 1.0%</td>
<td>S-1318D22-M5T1U4</td>
<td>S-1318D22-A4T2U4</td>
</tr>
<tr>
<td>2.3 V ± 1.0%</td>
<td>S-1318D23-M5T1U4</td>
<td>S-1318D23-A4T2U4</td>
</tr>
<tr>
<td>2.5 V ± 1.0%</td>
<td>S-1318D25-M5T1U4</td>
<td>S-1318D25-A4T2U4</td>
</tr>
<tr>
<td>2.8 V ± 1.0%</td>
<td>S-1318D28-M5T1U4</td>
<td>S-1318D28-A4T2U4</td>
</tr>
<tr>
<td>3.0 V ± 1.0%</td>
<td>S-1318D30-M5T1U4</td>
<td>S-1318D30-A4T2U4</td>
</tr>
<tr>
<td>3.3 V ± 1.0%</td>
<td>S-1318D33-M5T1U4</td>
<td>S-1318D33-A4T2U4</td>
</tr>
</tbody>
</table>

Remark Please contact our sales office for products with specifications other than the above.
### Pin Configurations

1. **SOT-23-5**

   ![Top view of SOT-23-5](image)

   **Figure 5**

   **Table 7**

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VIN</td>
<td>Input voltage pin</td>
</tr>
<tr>
<td>2</td>
<td>VSS</td>
<td>GND pin</td>
</tr>
<tr>
<td>3</td>
<td>ON / OFF</td>
<td>ON / OFF pin</td>
</tr>
<tr>
<td>4</td>
<td>NC(^1)</td>
<td>No connection</td>
</tr>
<tr>
<td>5</td>
<td>VOUT</td>
<td>Output voltage pin</td>
</tr>
</tbody>
</table>

*1. The NC pin is electrically open. The NC pin can be connected to the VIN pin or the VSS pin.

2. **HSNT-4(1010)**

   ![Top view of HSNT-4(1010)](image)

   **Figure 6**

   **Table 8**

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VOUT</td>
<td>Output voltage pin</td>
</tr>
<tr>
<td>2</td>
<td>VSS</td>
<td>GND pin</td>
</tr>
<tr>
<td>3</td>
<td>ON / OFF</td>
<td>ON / OFF pin</td>
</tr>
<tr>
<td>4</td>
<td>VIN</td>
<td>Input voltage pin</td>
</tr>
</tbody>
</table>

*1. Connect the heat sink of backside at shadowed area to the board, and set electric potential GND. However, do not use it as the function of electrode.
■ Absolute Maximum Ratings

Table 9

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Absolute Maximum Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>$V_{IN}$</td>
<td>$V_{SS} - 0.3$ to $V_{SS} + 6.0$</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>$V_{ON/OFF}$</td>
<td>$V_{SS} - 0.3$ to $V_{SS} + 6.0$</td>
<td>V</td>
</tr>
<tr>
<td>Output voltage</td>
<td>$V_{OUT}$</td>
<td>$V_{SS} - 0.3$ to $V_{IN} + 0.3$</td>
<td>V</td>
</tr>
<tr>
<td>Output current</td>
<td>$I_{OUT}$</td>
<td>120 mA</td>
<td>mA</td>
</tr>
<tr>
<td>Operation ambient temperature</td>
<td>$T_{opr}$</td>
<td>$-40$ to $+85$</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td>$-40$ to $+125$</td>
<td>°C</td>
</tr>
</tbody>
</table>

Caution: The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

■ Thermal Resistance Value

Table 10

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junction-to-ambient thermal resistance $^*$1</td>
<td>$\theta_{JA}$</td>
<td>SOT-23-5</td>
<td>Board A</td>
<td>–</td>
<td>192</td>
<td>°C/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Board B</td>
<td>–</td>
<td>160</td>
<td>°C/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Board C</td>
<td>–</td>
<td>–</td>
<td>°C/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Board D</td>
<td>–</td>
<td>–</td>
<td>°C/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Board E</td>
<td>–</td>
<td>–</td>
<td>°C/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HSNT-4(1010)</td>
<td>Board A</td>
<td>–</td>
<td>378</td>
<td>°C/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Board B</td>
<td>–</td>
<td>317</td>
<td>°C/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Board C</td>
<td>–</td>
<td>–</td>
<td>°C/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Board D</td>
<td>–</td>
<td>–</td>
<td>°C/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Board E</td>
<td>–</td>
<td>–</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

$^*$1. Test environment: compliance with JEDEC STANDARD JESD51-2A

Remark: Refer to "■ Power Dissipation" and "Test Board" for details.
### Electrical Characteristics

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
<th>Test Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage(^1)</td>
<td>(V_{\text{OUT(S)}})</td>
<td>(V_{\text{IN}} = V_{\text{OUT(S)}} + 1.0 \text{ V},) (I_{\text{OUT}} = 10 \text{ mA})</td>
<td>(V_{\text{OUT(S)}} = 1.2 \text{ V})</td>
<td>(0.015)</td>
<td>(V_{\text{OUT(S)}})</td>
<td>(0.015)</td>
<td>(V)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(V_{\text{OUT(S)}} = 1.8 \text{ V}, 2.2 \text{ V}, 2.3 \text{ V}, 2.5 \text{ V}, 2.8 \text{ V}, 3.0 \text{ V}, 3.3 \text{ V})</td>
<td>(0.99)</td>
<td>(V_{\text{OUT(S)}})</td>
<td>(1.01)</td>
<td>(V)</td>
</tr>
<tr>
<td>Output current(^2)</td>
<td>(I_{\text{OUT}})</td>
<td>(V_{\text{IN}} \geq V_{\text{OUT(S)}} + 1.0 \text{ V})</td>
<td>(V_{\text{OUT(S)}} = 1.2 \text{ V})</td>
<td>(75^*)</td>
<td>–</td>
<td>–</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(V_{\text{OUT(S)}} = 1.8 \text{ V}, 2.2 \text{ V}, 2.3 \text{ V}, 2.5 \text{ V}, 2.8 \text{ V}, 3.0 \text{ V}, 3.3 \text{ V})</td>
<td>(100^*)</td>
<td>–</td>
<td>–</td>
<td>mA</td>
</tr>
<tr>
<td>Dropout voltage(^3)</td>
<td>(V_{\text{DROP}})</td>
<td>(I_{\text{OUT}} = 10 \text{ mA})</td>
<td>(V_{\text{OUT(S)}} = 1.2 \text{ V})</td>
<td>0.30</td>
<td>–</td>
<td>–</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(V_{\text{OUT(S)}} = 1.8 \text{ V})</td>
<td>–</td>
<td>0.055</td>
<td>0.070</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(V_{\text{OUT(S)}} = 2.2 \text{ V}, 2.3 \text{ V})</td>
<td>–</td>
<td>0.050</td>
<td>0.060</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(V_{\text{OUT(S)}} = 2.5 \text{ V}, 2.8 \text{ V}, 3.0 \text{ V}, 3.3 \text{ V})</td>
<td>–</td>
<td>0.045</td>
<td>0.050</td>
<td>V</td>
</tr>
<tr>
<td>Line regulation</td>
<td>(\frac{\Delta V_{\text{OUT1}}}{\Delta V_{\text{IN}}})</td>
<td>(V_{\text{OUT(S)}} + 0.5 \text{ V} \leq V_{\text{IN}} \leq 5.5 \text{ V}, I_{\text{OUT}} = 10 \text{ mA})</td>
<td>–</td>
<td>0.05</td>
<td>0.2</td>
<td>%/V</td>
<td>1</td>
</tr>
<tr>
<td>Load regulation</td>
<td>(\frac{\Delta V_{\text{OUT2}}}{\Delta V_{\text{IN}}})</td>
<td>(V_{\text{IN}} = V_{\text{OUT(S)}} + 1.0 \text{ V}, 1 \mu\text{A} \leq I_{\text{OUT}} \leq 50 \text{ mA})</td>
<td>–</td>
<td>20</td>
<td>40</td>
<td>mV</td>
<td>1</td>
</tr>
<tr>
<td>Output voltage temperature coefficient(^4)</td>
<td>(\frac{\Delta V_{\text{OUT}}}{\Delta T_{\text{A}}})</td>
<td>(V_{\text{IN}} = V_{\text{OUT(S)}} + 1.0 \text{ V}, 10 \text{ mA}, -40^\circ \text{C} \leq T_{\text{A}} \leq +85^\circ \text{C})</td>
<td>–</td>
<td>(\pm 130)</td>
<td>–</td>
<td>ppm/°C</td>
<td>1</td>
</tr>
<tr>
<td>Current consumption during operation</td>
<td>(I_{\text{SS1}})</td>
<td>(V_{\text{IN}} = V_{\text{OUT(S)}} + 1.0 \text{ V}, \text{ON / OFF pin = ON, no load})</td>
<td>–</td>
<td>95</td>
<td>250</td>
<td>nA</td>
<td>2</td>
</tr>
<tr>
<td>Current consumption during power-off</td>
<td>(I_{\text{SS2}})</td>
<td>(V_{\text{IN}} = V_{\text{OUT(S)}} + 1.0 \text{ V}, \text{ON / OFF pin = OFF, no load})</td>
<td>–</td>
<td>2</td>
<td>55</td>
<td>nA</td>
<td>2</td>
</tr>
<tr>
<td>Input voltage</td>
<td>(V_{\text{IN}})</td>
<td>–</td>
<td>1.7</td>
<td>–</td>
<td>5.5</td>
<td>V</td>
<td>–</td>
</tr>
<tr>
<td>ON / OFF pin input voltage &quot;H&quot;</td>
<td>(V_{\text{SH}})</td>
<td>(V_{\text{IN}} = V_{\text{OUT(S)}} + 1.0 \text{ V}, R_{\text{L}} = 1.0 \text{ k}\Omega,) determined by (V_{\text{OUT}}) output level</td>
<td>1.0</td>
<td>–</td>
<td>–</td>
<td>V</td>
<td>4</td>
</tr>
<tr>
<td>ON / OFF pin input voltage &quot;L&quot;</td>
<td>(V_{\text{SL}})</td>
<td>(V_{\text{IN}} = V_{\text{OUT(S)}} + 1.0 \text{ V}, R_{\text{L}} = 1.0 \text{ k}\Omega,) determined by (V_{\text{OUT}}) output level</td>
<td>–</td>
<td>–</td>
<td>0.25</td>
<td>V</td>
<td>4</td>
</tr>
<tr>
<td>ON / OFF pin pull-down current</td>
<td>(I_{\text{SH}})</td>
<td>(V_{\text{IN}} = 5.5 \text{ V}, V_{\text{ON / OFF}} = 5.5 \text{ V}) (\text{A / C type (with constant current source pull-down)})</td>
<td>0.05</td>
<td>0.1</td>
<td>0.2</td>
<td>μA</td>
<td>4</td>
</tr>
<tr>
<td>Short-circuit current</td>
<td>(I_{\text{short}})</td>
<td>(V_{\text{IN}} = V_{\text{OUT(S)}} + 1.0 \text{ V},) (\text{ON / OFF pin = ON, V_{OUT} = 0 V})</td>
<td>–</td>
<td>50</td>
<td>–</td>
<td>mA</td>
<td>3</td>
</tr>
<tr>
<td>Discharge shunt resistance during power-off</td>
<td>(R_{\text{LOW}})</td>
<td>(V_{\text{OUT}} = 0.1 \text{ V}, V_{\text{IN}} = 5.5 \text{ V}) (\text{A / B type (with discharge shunt function)})</td>
<td>–</td>
<td>35</td>
<td>–</td>
<td>Ω</td>
<td>3</td>
</tr>
</tbody>
</table>
5.5 V INPUT, 100 mA, 95 nA SUPER LOW CURRENT CONSUMPTION VOLTAGE REGULATOR
S-1318 Series

*1. \(V_{OUT(S)}\): Set output voltage
   \(V_{OUT(E)}\): Actual output voltage
   The output voltage when \(V_{IN} = V_{OUT(S)} + 1.0 \text{ V}\), \(I_{OUT} = 10 \text{ mA}\)

*2. The output current at which the output voltage becomes 95% of \(V_{OUT(E)}\) after gradually increasing the output current.

*3. \(V_{drop} = V_{IN1} - (V_{OUT3} \times 0.98)\)
   \(V_{IN1}\) is the input voltage at which the output voltage becomes 98% of \(V_{OUT3}\) after gradually decreasing the input voltage.
   \(V_{OUT3}\) is the output voltage when \(V_{IN} = V_{OUT(S)} + 1.0 \text{ V}\) and \(I_{OUT} = 10 \text{ mA}\).

*4. A change in the temperature of the output voltage [mV/°C] is calculated using the following equation.
   \[
   \frac{\Delta V_{OUT}}{\Delta T_a} \text{[mV/°C]} = V_{OUT(S)} \text{[V]}^2 \times \frac{\Delta V_{OUT}}{\Delta T_a \cdot V_{OUT}} \text{[ppm/°C]}^3 \div 1000
   \]
   *1. Change in temperature of output voltage
   *2. Set output voltage
   *3. Output voltage temperature coefficient

*5. Due to limitation of the power dissipation, this value may not be satisfied. Attention should be paid to the power dissipation when the output current is large.
   This specification is guaranteed by design.
Test Circuits

Figure 7  Test Circuit 1

Figure 8  Test Circuit 2

Figure 9  Test Circuit 3

Figure 10  Test Circuit 4
5.5 V INPUT, 100 mA, 95 nA SUPER LOW CURRENT CONSUMPTION VOLTAGE REGULATOR
S-1318 Series

■ Standard Circuit

![Diagram of Standard Circuit](image)

*1. C_{IN} is a capacitor for stabilizing the input.
*2. C_{L} is a capacitor for stabilizing the output.

**Figure 11**

Caution The above connection diagram and constants will not guarantee successful operation. Perform thorough evaluation including the temperature characteristics with an actual application to set the constants.

■ Condition of Application

- Input capacitor (C_{IN}): A ceramic capacitor with capacitance of 1.0 \( \mu \)F or more is recommended.
- Output capacitor (C_{L}): A ceramic capacitor with capacitance of 1.0 \( \mu \)F or more is recommended.

**Caution** Generally, in a voltage regulator, an oscillation may occur depending on the selection of the external parts. Perform thorough evaluation including the temperature characteristics with an actual application using the above capacitors to confirm no oscillation occurs.

■ Selection of Input Capacitor (C_{IN}) and Output Capacitor (C_{L})

The S-1318 Series requires C_{L} between the VOUT pin and the VSS pin for phase compensation. The operation is stabilized by a ceramic capacitor with capacitance of 1.0 \( \mu \)F or more. When using an OS capacitor, a tantalum capacitor or an aluminum electrolytic capacitor, the capacitance also must be 1.0 \( \mu \)F or more. However, an oscillation may occur depending on the equivalent series resistance (ESR).
Moreover, the S-1318 Series requires C_{IN} between the VIN pin and the VSS pin for a stable operation.
Generally, an oscillation may occur when a voltage regulator is used under the condition that the impedance of the power supply is high.
Note that the output voltage transient characteristics vary depending on the capacitance of C_{IN} and C_{L} and the value of ESR.

**Caution** Perform thorough evaluation including the temperature characteristics with an actual application to select C_{IN} and C_{L}.

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### Explanation of Terms

1. **Output voltage (V\textsubscript{OUT})**
   
   This voltage is output at an accuracy of ±1.0% or ±15 mV\(^2\) when the input voltage, the output current and the temperature are in a certain condition\(^1\).

   *1. Differs depending on the product.
   *2. When V\textsubscript{OUT} = 1.2 V: ±15 mV, when V\textsubscript{OUT} = 1.8 V, 2.2 V, 2.3 V, 2.5 V, 2.8 V, 3.0 V, 3.3 V: ±1.0%

   Caution If the certain condition is not satisfied, the output voltage may exceed the accuracy range of ±1.0% or ±15 mV. Refer to Table 11 in "Electrical Characteristics" for details.

2. **Line regulation \(\left( \frac{\Delta V\text{\textsubscript{OUT1}}}{\Delta V\text{\textsubscript{IN}} \times V\text{\textsubscript{OUT}}} \right)\)**
   
   Indicates the dependency of the output voltage against the input voltage. The value shows how much the output voltage changes due to a change in the input voltage after fixing output current constant.

3. **Load regulation (\(\Delta V\text{\textsubscript{OUT2}}\))**
   
   Indicates the dependency of the output voltage against the output current. The value shows how much the output voltage changes due to a change in the output current after fixing input voltage constant.

4. **Dropout voltage (V\text{\textsubscript{drop}})**
   
   Indicates the difference between input voltage (V\textsubscript{IN1}) and the output voltage when the output voltage becomes 98% of the output voltage value (V\textsubscript{OUT3}) at V\textsubscript{IN} = V\textsubscript{OUT(S)} + 1.0 V after the input voltage (V\textsubscript{IN}) is decreased gradually.

   \[
   V\text{\textsubscript{drop}} = V\text{\textsubscript{IN1}} - (V\text{\textsubscript{OUT3}} \times 0.98)
   \]
5. Output voltage temperature coefficient \( \frac{\Delta V_{\text{OUT}}}{\Delta T_a \cdot V_{\text{OUT}}} \)

The shaded area in Figure 12 is the range where \( V_{\text{OUT}} \) varies in the operation temperature range when the output voltage temperature coefficient is \( \pm 130 \text{ ppm/°C} \).

![Example of S-1318A12 typ. product](image)

**Figure 12**

A change in the temperature of the output voltage \( [\text{mV/°C}] \) is calculated using the following equation.

\[
\frac{\Delta V_{\text{OUT}}}{\Delta T_a} \text{[mV/°C]}^* = \frac{V_{\text{OUT}(S)}}{[\text{V}]}^2 \times \frac{\Delta V_{\text{OUT}}}{\Delta T_a \cdot V_{\text{OUT}}} \text{[ppm/°C]}^2 \div 1000
\]

*1. Change in temperature of output voltage
*2. Set output voltage
*3. Output voltage temperature coefficient
## Operation

1. **Basic operation**

   Figure 13 shows the block diagram of the S-1318 Series to describe the basic operation. The error amplifier compares the feedback voltage \( V_{fb} \) whose output voltage \( V_{OUT} \) is divided by the feedback resistors \( R_s \) and \( R_f \) with the reference voltage \( V_{ref} \). The error amplifier controls the output transistor, consequently, the regulator starts the operation that keeps \( V_{OUT} \) constant without the influence of the input voltage \( V_{IN} \).

   ![Block Diagram](image)

   Figure 13

   *1. Parasitic diode

2. **Output transistor**

   In the S-1318 Series, a low on-resistance P-channel MOS FET is used between the \( V_{IN} \) pin and the \( V_{OUT} \) pin as the output transistor. In order to keep \( V_{OUT} \) constant, the ON resistance of the output transistor varies appropriately according to the output current \( I_{OUT} \).

   **Caution** Since a parasitic diode exists between the \( V_{IN} \) pin and the \( V_{OUT} \) pin due to the structure of the transistor, the IC may be damaged by a reverse current if \( V_{OUT} \) becomes higher than \( V_{IN} \). Therefore, be sure that \( V_{OUT} \) does not exceed \( V_{IN} + 0.3 \) V.
3. **ON / OFF pin**

The ON / OFF pin controls the internal circuit and the output transistor in order to start and stop the regulator. When the ON / OFF pin is set to OFF, the internal circuit stops operating and the output transistor between the VIN pin and the VOUT pin is turned off, reducing current consumption significantly.

Note that the current consumption increases when a voltage of 0.25 V to $V_{IN} - 0.3$ V is applied to the ON / OFF pin. The ON / OFF pin is configured as shown in Figure 14 and Figure 15.

### 3.1 S-1318 Series A / C type

The ON / OFF pin is internally pulled down to the VSS pin in the floating status, so the VOUT pin is set to the VSS level.

For the ON / OFF pin current, refer to the A / C type of the ON / OFF pin input current "H" in "Electrical Characteristics".

### 3.2 S-1318 Series B / D type

The ON / OFF pin is not internally pulled down to the VSS pin, so do not use it in the floating status. When not using the ON / OFF pin, connect it to the VIN pin.

| Table 12 |
|-----------------|-----------------|-----------------|
| **Product Type** | **ON / OFF Pin** | **Internal Circuit** | **VOUT Pin Voltage** | **Current Consumption** |
| A / B / C / D    | "H": ON         | Operate          | Constant value *1  | $I_{SS1}$ *2           |
| A / B / C / D    | "L": OFF        | Stop             | Pulled down to $V_{SS}$ *3 | $I_{SS2}$ |

*1. The constant value is output due to the regulating based on the set output voltage value.

*2. Note that the IC’s current consumption increases as much as current flows into the constant current of 0.1 $\mu$A typ. when the ON / OFF pin is connected to the VIN pin and the S-1318 Series A / C type is operating (refer to Figure 14).

*3. The VOUT pin voltage of the S-1318 Series A / B type is pulled down to $V_{SS}$ due to combined resistance ($R_{LOW} = 35 \Omega$ typ.) of the discharge shunt circuit and the feedback resistors, and a load.

---

![Figure 14](image1.png)  
**S-1318 Series A / C type**

![Figure 15](image2.png)  
**S-1318 Series B / D type**
4. Discharge shunt function (S-1318 Series A / B type)

The S-1318 Series A / B type has a built-in discharge shunt circuit to discharge the output capacitance. The output capacitance is discharged as follows so that the VOUT pin reaches the VSS level.

1. The ON / OFF pin is set to OFF level.
2. The output transistor is turned off.
3. The discharge shunt circuit is turned on.
4. The output capacitor discharges.

Since the S-1318 Series C / D type does not have a discharge shunt circuit, the VOUT pin is set to VSS level through several MΩ internal divided resistors between the VOUT pin and the VSS pin. The S-1318 Series A / B type allows the VOUT pin to reach the VSS level rapidly due to the discharge shunt circuit.

![Diagram of discharge shunt function](image)

*1. Parasitic diode

Figure 16

5. Constant current source pull-down (S-1318 Series A / C type)

The ON / OFF pin is internally pulled down to the VSS pin in the floating status, so the VOUT pin is set to the VSS level. Note that the IC's current consumption increases as much as current flows into the constant current of 0.1 μA typ. when the ON / OFF pin is connected to the VIN pin and the S-1318 Series A / C type is operating.
6. Overcurrent protection circuit

The S-1318 Series has a built-in overcurrent protection circuit to limit the overcurrent of the output transistor. When the VOUT pin is shorted to the VSS pin, that is, at the time of the output short-circuit, the output current is limited to 50 mA typ. due to the overcurrent protection circuit operation. The S-1318 Series restarts regulating when the output transistor is released from the overcurrent status.

Caution  This overcurrent protection circuit does not work as for thermal protection. For example, when the output transistor keeps the overcurrent status long at the time of output short-circuit or due to other reasons, pay attention to the conditions of the input voltage and the load current so as not to exceed the power dissipation.
**Precautions**

- Generally, when a voltage regulator is used under the condition that the load current value is small (1 μA or less), the output voltage may increase due to the leakage current of an output transistor.

- Generally, when a voltage regulator is used under the condition that the temperature is high, the output voltage may increase due to the leakage current of an output transistor.

- Generally, when a voltage regulator is used under the condition that the impedance of the power supply is high, an oscillation may occur. Perform thorough evaluation including the temperature characteristics with an actual application to select $C_{IN}$.

- Generally, in a voltage regulator, an oscillation may occur depending on the selection of the external parts. The following use conditions are recommended in the S-1318 Series, however, perform thorough evaluation including the temperature characteristics with an actual application to select $C_{IN}$ and $C_L$.

  - Input capacitor ($C_{IN}$): A ceramic capacitor with capacitance of 1.0 μF or more is recommended.
  - Output capacitor ($C_L$): A ceramic capacitor with capacitance of 1.0 μF or more is recommended.

- Generally, in a voltage regulator, the values of an overshoot and an undershoot in the output voltage vary depending on the variation factors of input voltage start-up, input voltage fluctuation and load fluctuation etc., or the capacitance of $C_{IN}$ or $C_L$ and the value of the equivalent series resistance (ESR), which may cause a problem to the stable operation. Perform thorough evaluation including the temperature characteristics with an actual application to select $C_{IN}$ and $C_L$.

- Generally, in a voltage regulator, if the VOUT pin is steeply shorted with GND, a negative voltage exceeding the absolute maximum ratings may occur in the VOUT pin due to resonance phenomenon of the inductance and the capacitance including $C_L$ on the application. The resonance phenomenon is expected to be weakened by inserting a series resistor into the resonance path, and the negative voltage is expected to be limited by inserting a protection diode between the VOUT pin and the VSS pin.

- Make sure of the conditions for the input voltage, output voltage and the load current so that the internal loss does not exceed the power dissipation.

- Do not apply an electrostatic discharge to this IC that exceeds the performance ratings of the built-in electrostatic protection circuit.

- When considering the output current value that the IC is able to output, make sure of the output current value specified in Table 11 in " Electrical Characteristics" and footnote *5 of the table.

- Wiring patterns on the application related to the VIN pin, the VOUT pin and the VSS pin should be designed so that the impedance is low. When mounting $C_{IN}$ between the VIN pin and the VSS pin and $C_L$ between the VOUT pin and the VSS pin, connect the capacitors as close as possible to the respective destination pins of the IC.

- In the package equipped with heat sink of backside, mount the heat sink firmly. Since the heat radiation differs according to the condition of the application, perform thorough evaluation with an actual application to confirm no problems happen.

- 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.
Characteristics (Typical Data)

1. Output voltage vs. Output current (When load current increases) (Ta = +25°C)

1.1 $V_{OUT} = 1.0$ V

1.2 $V_{OUT} = 1.5$ V

1.3 $V_{OUT} = 3.5$ V

Remark

In determining the output current, attention should be paid to the following.

1. The minimum output current value and footnote *5 in Table 11 in "Electrical Characteristics".
2. The power dissipation

2. Output voltage vs. Input voltage (Ta = +25°C)

2.1 $V_{OUT} = 1.0$ V

2.2 $V_{OUT} = 1.5$ V

2.3 $V_{OUT} = 3.5$ V
3. Dropout voltage vs. Output current

3.1 $V_{\text{OUT}} = 1.0\, \text{V}$

3.2 $V_{\text{OUT}} = 1.5\, \text{V}$

3.3 $V_{\text{OUT}} = 3.5\, \text{V}$

4. Dropout voltage vs. Set output voltage
5. Output voltage vs. Ambient temperature

5.1 \( V_{OUT} = 1.0 \text{ V} \)

\[
\begin{array}{c|c|c|c|c|c|c}
\text{Ta [°C]} & -40 & -25 & 0 & 25 & 50 & 75 & 85 \\
\hline
V_{OUT} [\text{V}] & 1.10 & & & & & & \\
\end{array}
\]

5.2 \( V_{OUT} = 1.5 \text{ V} \)

\[
\begin{array}{c|c|c|c|c|c|c}
\text{Ta [°C]} & -40 & -25 & 0 & 25 & 50 & 75 & 85 \\
\hline
V_{OUT} [\text{V}] & 1.70 & & & & & & \\
\end{array}
\]

5.3 \( V_{OUT} = 3.5 \text{ V} \)

\[
\begin{array}{c|c|c|c|c|c|c}
\text{Ta [°C]} & -40 & -25 & 0 & 25 & 50 & 75 & 85 \\
\hline
V_{OUT} [\text{V}] & 3.20 & & & & & & \\
\end{array}
\]
6. Current consumption vs. Input voltage

6.1 $V_{OUT} = 1.0$ V

6.2 $V_{OUT} = 1.5$ V

6.3 $V_{OUT} = 3.5$ V
7. Current consumption vs. Ambient temperature

7.1 \( V_{OUT} = 1.0 \, V \)

\[
\begin{array}{c|cccc}
\text{Ta [°C]} & -40 & -25 & 0 & 25 & 50 & 75 & 85 \\
\hline
ISS1 [\mu A] & 0.0 & 0.1 & 0.2 & 0.3 & 0.4 & 0.5 & 0.6 & 0.7 \\
\hline
\end{array}
\]

\( V_{IN} = 2.0 \, V \) for \( V_{OUT} = 1.0 \, V \)

\( V_{IN} = 5.5 \, V \)

7.2 \( V_{OUT} = 1.5 \, V \)

\[
\begin{array}{c|cccc}
\text{Ta [°C]} & -40 & -25 & 0 & 25 & 50 & 75 & 85 \\
\hline
ISS1 [\mu A] & 0.0 & 0.1 & 0.2 & 0.3 & 0.4 & 0.5 & 0.6 & 0.7 \\
\hline
\end{array}
\]

\( V_{IN} = 2.5 \, V \) for \( V_{OUT} = 1.5 \, V \)

\( V_{IN} = 5.5 \, V \)

7.3 \( V_{OUT} = 3.5 \, V \)

\[
\begin{array}{c|cccc}
\text{Ta [°C]} & -40 & -25 & 0 & 25 & 50 & 75 & 85 \\
\hline
ISS1 [\mu A] & 0.0 & 0.1 & 0.2 & 0.3 & 0.4 & 0.5 & 0.6 & 0.7 \\
\hline
\end{array}
\]

\( V_{IN} = 4.5 \, V \) for \( V_{OUT} = 3.5 \, V \)

\( V_{IN} = 5.5 \, V \)

8. Current consumption vs. Output current

8.1 \( V_{OUT} = 1.0 \, V \)

\[
\begin{array}{c|cccc}
I_{OUT} [mA] & 0 & 20 & 40 & 60 & 80 & 100 \\
\hline
ISS1 [\mu A] & 0 & 10 & 20 & 30 & 40 \\
\hline
\end{array}
\]

\( V_{IN} = 2.0 \, V \) for \( V_{OUT} = 1.0 \, V \)

\( V_{IN} = 5.5 \, V \)

8.2 \( V_{OUT} = 1.5 \, V \)

\[
\begin{array}{c|cccc}
I_{OUT} [mA] & 0 & 20 & 40 & 60 & 80 & 100 \\
\hline
ISS1 [\mu A] & 0 & 10 & 20 & 30 & 40 \\
\hline
\end{array}
\]

\( V_{IN} = 2.5 \, V \) for \( V_{OUT} = 1.5 \, V \)

\( V_{IN} = 5.5 \, V \)

8.3 \( V_{OUT} = 3.5 \, V \)

\[
\begin{array}{c|cccc}
I_{OUT} [mA] & 0 & 20 & 40 & 60 & 80 & 100 \\
\hline
ISS1 [\mu A] & 0 & 10 & 20 & 30 & 40 \\
\hline
\end{array}
\]

\( V_{IN} = 4.5 \, V \) for \( V_{OUT} = 3.5 \, V \)

\( V_{IN} = 5.5 \, V \)
Reference Data

1. Transient response characteristics when input (Ta = +25°C)

1.1 \( V_{\text{OUT}} = 1.0 \) V

\( I_{\text{OUT}} = 1 \) mA, \( C_{\text{IN}} = C_{\text{L}} = 1.0 \) μF,
\( V_{\text{IN}} = 2.0 \) V → 3.0 V, \( t_r = 5.0 \) μs

1.2 \( V_{\text{OUT}} = 1.5 \) V

\( I_{\text{OUT}} = 1 \) mA, \( C_{\text{IN}} = C_{\text{L}} = 1.0 \) μF,
\( V_{\text{IN}} = 2.5 \) V → 3.5 V, \( t_r = 5.0 \) μs
5.5 V INPUT, 100 mA, 95 nA SUPER LOW CURRENT CONSUMPTION VOLTAGE REGULATOR
S-1318 Series

1.3 \(V_{\text{OUT}} = 3.5\) V

\[I_{\text{OUT}} = 1\ mA,\ C_{\text{IN}} = C_{\text{L}} = 1\ \mu\text{F},\ V_{\text{IN}} = 4.5\ \text{V} \rightarrow 5.5\ \text{V},\ t_r = 5.0\ \mu\text{s}\]

\[V_{\text{IN}}, V_{\text{OUT}}\]

\[V_{\text{IN}} - V_{\text{OUT}}\]

\[t [\mu\text{s}]

\[\text{VIN} [\text{V}] = 4.1 \rightarrow 6.5\]

\[\text{VOUT} [\text{V}] = 3.9 \rightarrow 5.5\]

\[\text{VOUT} [\text{V}] = 3.5 \rightarrow 3.5\]

\[0 \rightarrow 200 \rightarrow 400 \rightarrow 600 \rightarrow 800\]

\[I_{\text{OUT}} = 50\ mA,\ C_{\text{IN}} = C_{\text{L}} = 1\ \mu\text{F},\ V_{\text{IN}} = 4.5\ \text{V} \rightarrow 5.5\ \text{V},\ t_r = 5.0\ \mu\text{s}\]

\[V_{\text{IN}}, V_{\text{OUT}}\]

\[V_{\text{IN}} - V_{\text{OUT}}\]

\[t [\mu\text{s}]

\[\text{VIN} [\text{V}] = 4.1 \rightarrow 6.5\]

\[\text{VOUT} [\text{V}] = 3.9 \rightarrow 5.5\]

\[\text{VOUT} [\text{V}] = 3.5 \rightarrow 3.5\]

\[0 \rightarrow 200 \rightarrow 400 \rightarrow 600 \rightarrow 800\]
2. Transient response characteristics of load (Ta = +25°C)

2.1 $V_{OUT} = 1.0\ V$

$V_{IN} = 2.0\ V, C_{IN} = C_{L} = 1.0\ \mu F, I_{OUT} = 1\ mA \rightarrow 10\ mA, t_r = 5.0\ \mu s$

$V_{IN} = 2.0\ V, C_{IN} = C_{L} = 1.0\ \mu F, I_{OUT} = 10\ mA \rightarrow 1\ mA, t_f = 5.0\ \mu s$

2.2 $V_{OUT} = 1.5\ V$

$V_{IN} = 2.5\ V, C_{IN} = C_{L} = 1.0\ \mu F, I_{OUT} = 1\ mA \rightarrow 10\ mA, t_r = 5.0\ \mu s$

$V_{IN} = 2.5\ V, C_{IN} = C_{L} = 1.0\ \mu F, I_{OUT} = 10\ mA \rightarrow 1\ mA, t_f = 5.0\ \mu s$
2.3 $V_{OUT} = 3.5 \text{ V}$

$V_{IN} = 4.5 \text{ V}, C_{IN} = C_L = 1.0 \mu \text{F}$,

$I_{OUT} = 1 \text{ mA} \rightarrow 10 \text{ mA}, t_r = 5.0 \mu \text{s}$

$I_{OUT} = 10 \text{ mA} \rightarrow 1 \text{ mA}, t_f = 5.0 \mu \text{s}$

$V_{IN} = 4.5 \text{ V}, C_{IN} = C_L = 1.0 \mu \text{F}$,

$I_{OUT} = 10 \text{ mA} \rightarrow 50 \text{ mA}, t_r = 5.0 \mu \text{s}$

$I_{OUT} = 50 \text{ mA} \rightarrow 10 \text{ mA}, t_f = 5.0 \mu \text{s}$

$V_{OUT} \text{ [V]}$

$V_{OUT} \text{ [V]}$

$I_{OUT} \text{ [mA]}$

$I_{OUT} \text{ [mA]}$

$t \text{ [\mu s]}$

$t \text{ [\mu s]}$

$V_{OUT} \text{ [V]}$

$V_{OUT} \text{ [V]}$

$I_{OUT} \text{ [mA]}$

$I_{OUT} \text{ [mA]}$
3. Transient response characteristics of ON / OFF pin (Ta = +25°C)

### 3.1 $V_{\text{OUT}} = 1.0$ V

$V_{\text{IN}} = 2.0$ V, $C_{\text{IN}} = C_{\text{L}} = 1.0$ μF, $I_{\text{OUT}} = 1$ mA,

$V_{\text{ON/OFF}} = 0$ V → $2.0$ V, $t_r = 1.0$ μs

3.2 $V_{\text{OUT}} = 1.5$ V

$V_{\text{IN}} = 2.5$ V, $C_{\text{IN}} = C_{\text{L}} = 1.0$ μF, $I_{\text{OUT}} = 1$ mA,

$V_{\text{ON/OFF}} = 0$ V → $2.5$ V, $t_r = 1.0$ μs

3.3 $V_{\text{OUT}} = 3.5$ V

$V_{\text{IN}} = 4.5$ V, $C_{\text{IN}} = C_{\text{L}} = 1.0$ μF, $I_{\text{OUT}} = 1$ mA,

$V_{\text{ON/OFF}} = 0$ V → $4.5$ V, $t_r = 1.0$ μs
4. Ripple rejection (Ta = +25°C)

### 4.1 V\text{OUT} = 1.0\text{ V}

- \( V_\text{IN} = 2.0\text{ V}, C_L = 1.0\ \mu\text{F} \)

### 4.2 V\text{OUT} = 1.5\text{ V}

- \( V_\text{IN} = 2.5\text{ V}, C_L = 1.0\ \mu\text{F} \)

### 4.3 V\text{OUT} = 3.5\text{ V}

- \( V_\text{IN} = 4.5\text{ V}, C_L = 1.0\ \mu\text{F} \)
5. Output capacitance vs. Characteristics of discharge time (Ta = +25°C)

\[ t_{DSC} \begin{array}{c|c|c|c|c|c} \gamma & C_L [\mu F] & 0.0 & 2 & 4 & 6 \\ \hline V_{OUT(S)} & 1.0 V & 1.5 V & 3.5 V \\ \end{array} \]

\[ V_{IN} = V_{OUT} + 1.0 V, \ I_{OUT} = \text{no load}, \ V_{ON/OFF} = V_{OUT} + 1.0 V \rightarrow V_{SS}, \ t_f = 1.0 \mu s \]

\[ V_{OUT} \times 10\% \]

\[ V_{IN} = V_{OUT} + 1.0 V \]

\[ V_{ON/OFF} = V_{OUT} + 1.0 V \rightarrow V_{SS} \]

\[ 1 \mu s \]

Figure 17  S-1318 Series A / B type (with discharge shunt function)

Figure 18  Measurement Condition of Discharge Time

6. Example of equivalent series resistance vs. Output current characteristics (Ta = +25°C)

\[ V_{OUT(S)} = 1.8 V, 2.2 V, 2.3 V, 2.5 V, 2.8 V, 3.0 V, 3.3 V \]

\[ C_{IN} = C_L = 1.0 \mu F \]

\[ R_{ESR} [\Omega] \]

\[ 0 \]

\[ 100 \]

\[ 0.01 \]

\[ 100 \]

\[ I_{OUT} [mA] \]

\[ \text{Stable} \]

\[ \text{VOUT} \]

\[ \text{VIN} \]

\[ \text{VSS} \]

\[ \text{S-1318 Series} \]

\[ C_{L} \]

\[ R_{ESR} \]

\[ C_{L} : \text{TDK Corporation C3216X7R1H105K160AB (1.0 \mu F)} \]

*1

Figure 19

Figure 20
Power Dissipation

SOT-23-5

<table>
<thead>
<tr>
<th>Board</th>
<th>Power Dissipation (Pd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.52 W</td>
</tr>
<tr>
<td>B</td>
<td>0.63 W</td>
</tr>
<tr>
<td>C</td>
<td>–</td>
</tr>
<tr>
<td>D</td>
<td>–</td>
</tr>
<tr>
<td>E</td>
<td>–</td>
</tr>
</tbody>
</table>

HSNT-4(1010)

<table>
<thead>
<tr>
<th>Board</th>
<th>Power Dissipation (Pd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.26 W</td>
</tr>
<tr>
<td>B</td>
<td>0.32 W</td>
</tr>
<tr>
<td>C</td>
<td>–</td>
</tr>
<tr>
<td>D</td>
<td>–</td>
</tr>
<tr>
<td>E</td>
<td>–</td>
</tr>
</tbody>
</table>

Tj = +125°C max.
## SOT-23-3/3S/5/6 Test Board

### Board A

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size [mm]</td>
<td>114.3 x 76.2 x t1.6</td>
</tr>
<tr>
<td>Material</td>
<td>FR-4</td>
</tr>
<tr>
<td>Number of copper foil layer</td>
<td>2</td>
</tr>
<tr>
<td>Copper foil layer [mm]</td>
<td>1 Land pattern and wiring for testing: t0.070</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4 74.2 x 74.2 x t0.070</td>
</tr>
<tr>
<td>Thermal via</td>
<td>-</td>
</tr>
</tbody>
</table>

### Board B

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size [mm]</td>
<td>114.3 x 76.2 x t1.6</td>
</tr>
<tr>
<td>Material</td>
<td>FR-4</td>
</tr>
<tr>
<td>Number of copper foil layer</td>
<td>4</td>
</tr>
<tr>
<td>Copper foil layer [mm]</td>
<td>1 Land pattern and wiring for testing: t0.070</td>
</tr>
<tr>
<td></td>
<td>2 74.2 x 74.2 x t0.035</td>
</tr>
<tr>
<td></td>
<td>3 74.2 x 74.2 x t0.035</td>
</tr>
<tr>
<td></td>
<td>4 74.2 x 74.2 x t0.070</td>
</tr>
<tr>
<td>Thermal via</td>
<td>-</td>
</tr>
</tbody>
</table>

No. SOT23x-A-Board-SD-2.0

ABLIC Inc.
# HSNT-4(1010) Test Board

## (1) Board A

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Size [mm]</td>
<td>114.3 x 76.2 x 1.6</td>
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<tr>
<td>Material</td>
<td>FR-4</td>
</tr>
<tr>
<td>Number of copper foil layer</td>
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</tr>
<tr>
<td>Copper foil layer [mm]</td>
<td>1 - Land pattern and wiring for testing: t0.070</td>
</tr>
<tr>
<td></td>
<td>2 -</td>
</tr>
<tr>
<td></td>
<td>3 -</td>
</tr>
<tr>
<td></td>
<td>4 - 74.2 x 74.2 x t0.070</td>
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<tr>
<td>Thermal via</td>
<td>-</td>
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## (2) Board B

<table>
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<th>Item</th>
<th>Specification</th>
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</tr>
<tr>
<td>Material</td>
<td>FR-4</td>
</tr>
<tr>
<td>Number of copper foil layer</td>
<td>4</td>
</tr>
<tr>
<td>Copper foil layer [mm]</td>
<td>1 - Land pattern and wiring for testing: t0.070</td>
</tr>
<tr>
<td></td>
<td>2 - 74.2 x 74.2 x t0.035</td>
</tr>
<tr>
<td></td>
<td>3 - 74.2 x 74.2 x t0.035</td>
</tr>
<tr>
<td></td>
<td>4 - 74.2 x 74.2 x t0.070</td>
</tr>
<tr>
<td>Thermal via</td>
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No. HSNT4-B-Board-SD-1.0

ABLIC Inc.
No. MP005-A-C-SD-2.1

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<thead>
<tr>
<th>TITLE</th>
<th>SOT235-A-Carrier Tape</th>
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<tbody>
<tr>
<td>No.</td>
<td>MP005-A-C-SD-2.1</td>
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<tr>
<td>ANGLE</td>
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</tr>
<tr>
<td>UNIT</td>
<td>mm</td>
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</table>

ABLIC Inc.
Enlarged drawing in the central part

No. MP005-A-R-SD-1.1

<table>
<thead>
<tr>
<th>TITLE</th>
<th>SOT235-A-Reel</th>
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</thead>
<tbody>
<tr>
<td>No.</td>
<td>MP005-A-R-SD-1.1</td>
</tr>
<tr>
<td>ANGLE</td>
<td>QTY.</td>
</tr>
<tr>
<td>UNIT</td>
<td>mm</td>
</tr>
</tbody>
</table>

ABLIC Inc.
※ The heat sink of back side has different electric potential depending on the product. Confirm specifications of each product. Do not use it as the function of electrode.

No. PL004-A-P-SD-1.1
Enlarged drawing in the central part

No. PL004-A-R-SD-1.0

<table>
<thead>
<tr>
<th>TITLE</th>
<th>HSNT-4-B-Reel</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>PL004-A-R-SD-1.0</td>
</tr>
<tr>
<td>ANGLE</td>
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</tr>
<tr>
<td>QTY.</td>
<td>10,000</td>
</tr>
<tr>
<td>UNIT</td>
<td>mm</td>
</tr>
</tbody>
</table>

ABLIC Inc.
Land Pattern

Caution It is recommended to solder the heat sink to a board in order to ensure the heat radiation.

注意 放熱性を確保する為に、PKGの裏面放熱板（ヒートシンク）を基板に半田付けする事を推奨いたします。

Metal Mask Pattern

Caution ① Mask aperture ratio of the lead mounting part is 100%.
② Mask aperture ratio of the heat sink mounting part is 40%.
③ Mask thickness: t0.10mm to 0.12 mm

注意 ①リード実装部のマスク開口率は100％です。
②放熱板実装のマスク開口率は40％です。
③マスク厚み：t0.10mm～0.12 mm

No. PL004-A-L-SD-2.0

<table>
<thead>
<tr>
<th>TITLE</th>
<th>HSNT-4-B -Land Recommendation</th>
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<tbody>
<tr>
<td>No.</td>
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<tr>
<td>ANGLE</td>
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</tr>
<tr>
<td>UNIT</td>
<td>mm</td>
</tr>
</tbody>
</table>

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