

## Automotive IPS series

# 1ch High-side switch

### BD1Hx500 Series

#### Features

- Built-in overcurrent protection circuit
  - Built-in Thermal Shut Down(TSD)
  - Built-in Open Load Detection circuit(When Output is OFF)
  - Possibility to control directly from CMOS logic IC
  - Low standby current
  - Built-in Under Voltage Lock Out circuit
  - Built-in diagnostic(ST) output function
  - Low On resistance of  $R_{DS(ON)}=500m\Omega(Typ)$  ( $V_{DD}=12V$ ,  $T_a=25^\circ C$ ,  $I_o=0.25A$ )
  - Monolithic power IC that has a built in control part (CMOS) and a power MOS FET on 1chip
  - 1ch High-side switch for the mechanical relay coil drive
  - AEC-Q100 qualified <sup>(1)</sup>
- (1) Grade 1

#### Product Summary

|                                    |           |
|------------------------------------|-----------|
| Operating voltage                  | 4V to 18V |
| On-state resistance<br>(25°C, Typ) | 500mΩ     |
| Overcurrent limit (Typ)            | 1.45A     |
| Active clamp energy (25°C)         | 33mJ      |

#### Package

HTSOP-J8  
 HSON8  
 MSOP8

4.90mm x 6.00mm x 1.00mm  
 2.90mm x 3.00mm x 0.60mm  
 2.90mm x 4.00mm x 0.90mm



HTSOP-J8

HSON 8

MSOP 8

#### General Description

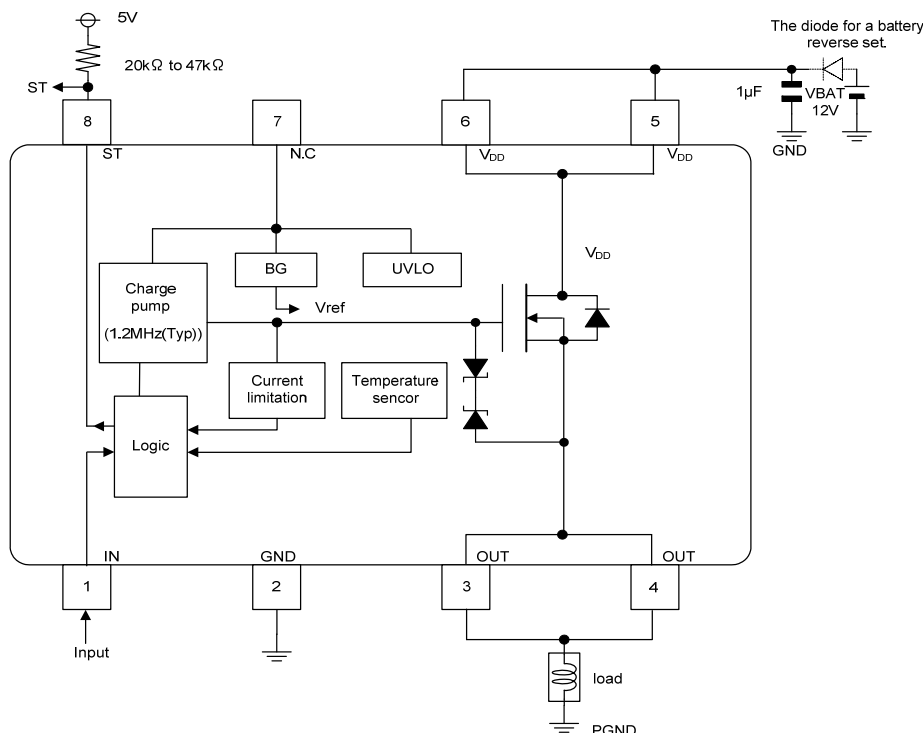
BD1HC/D500 Series is an Automotive 1ch High-Side switch.

It has a built-in overcurrent protection circuit, Thermal Shut Down (TSD) circuit, Open Load Detection circuit, Under Voltage Lock Out circuit, and has diagnostic (ST) output function at the time during abnormal detection.

#### Application

- For automotive (Air conditioner, body equipment, and meter, etc.)

#### Typical Application Circuit

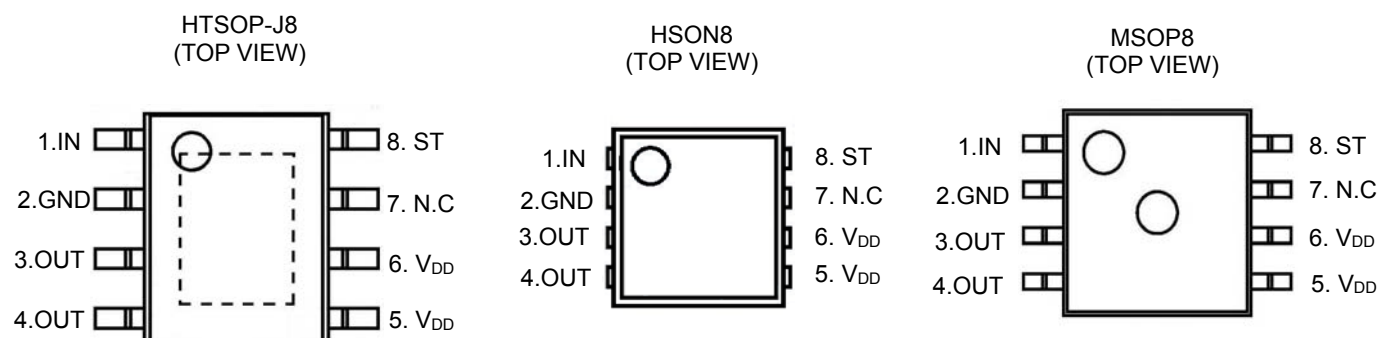


## Pin Descriptions

| Pin                        | Symbol          | Function                                                                                                                                                                                                                                                 |
|----------------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                          | IN              | Input terminal. The pull-down resistor is internally connected.                                                                                                                                                                                          |
| 2                          | GND             | Earth terminal.                                                                                                                                                                                                                                          |
| 3, 4                       | OUT             | Output terminal. When the load becomes in a short-circuit state and if the current exceeds overcurrent detection value of 0.8A (Min) the current flowing in the output pin will be limited due IC protection.                                            |
| 5, 6                       | V <sub>DD</sub> | Power-supply terminal.                                                                                                                                                                                                                                   |
| 7                          | N.C             | N.C                                                                                                                                                                                                                                                      |
| 8                          | ST              | Self-diagnostic output terminal. "L" is becomes the output state during overcurrent, overheating and open load detection conditions.<br>Please refer to Diagnostic Output Truth Table on page 5. The circuit is composed of an open drain N channel MOS. |
| Cooling Tab <sup>(1)</sup> | TAB             | Since it has connected with sub of IC, please connect the heat dissipation metal to external GND potential. (HTSOP-J8,HSON8)                                                                                                                             |

(1)MSOP8 does not have Cooling Tab.

## Pin Configurations



## Product Line-up

| Product Name  | PKG      | TSD Function | On-state Resistance (25°C, Typ) |
|---------------|----------|--------------|---------------------------------|
| BD1HC500EFJ-C | HTSOP-J8 | Off-latch    | 500mΩ                           |
| BD1HC500HFN-C | HSO N 8  |              |                                 |
| BD1HC500FVM-C | MSOP 8   |              |                                 |
| BD1HD500EFJ-C | HTSOP-J8 | Self-restart |                                 |
| BD1HD500HFN-C | HSO N 8  |              |                                 |
| BD1HD500FVM-C | MSOP 8   |              |                                 |

## Absolute Maximum Ratings

| Parameter                          | Symbol     | Rating                             | Unit |
|------------------------------------|------------|------------------------------------|------|
| Voltage between drain and source   | $V_{DS}$   | 44.5 (Internal limitation)         | V    |
| Power supply voltage               | $V_{DD}$   | 40                                 | V    |
| Input voltage                      | $V_{IN}$   | -0.3 to +12 <sup>(1)</sup>         | V    |
| Diagnostic output voltage          | $V_{ST}$   | -0.3 to +15 <sup>(1)</sup>         | V    |
| Output current (DC)                | $I_{OD}$   | 0.8 <sup>(2)</sup>                 | A    |
| Output current (Pulse)             | $I_{OP}$   | Internal limitation <sup>(3)</sup> | A    |
| Diagnostic output current          | $I_{ST}$   | 1                                  | mA   |
| Power Consumption                  | $P_d$      | 2.100 (HTSOP-J8) <sup>(4)</sup>    | W    |
|                                    |            | 1.750(HSON 8) <sup>(5)</sup>       |      |
|                                    |            | 0.587 (MSOP 8) <sup>(6)</sup>      |      |
| Operating temperature range        | $T_{opr}$  | $-40 \leq T_{opr} < +150$          | °C   |
| Storage temperature range          | $T_{stg}$  | -55 to +150                        | °C   |
| Maximum junction temperature       | $T_{jmax}$ | 150                                | °C   |
| Active clamp energy (single pulse) | $E_{AV}$   | 33                                 | mJ   |

## Operating Voltage Ratings

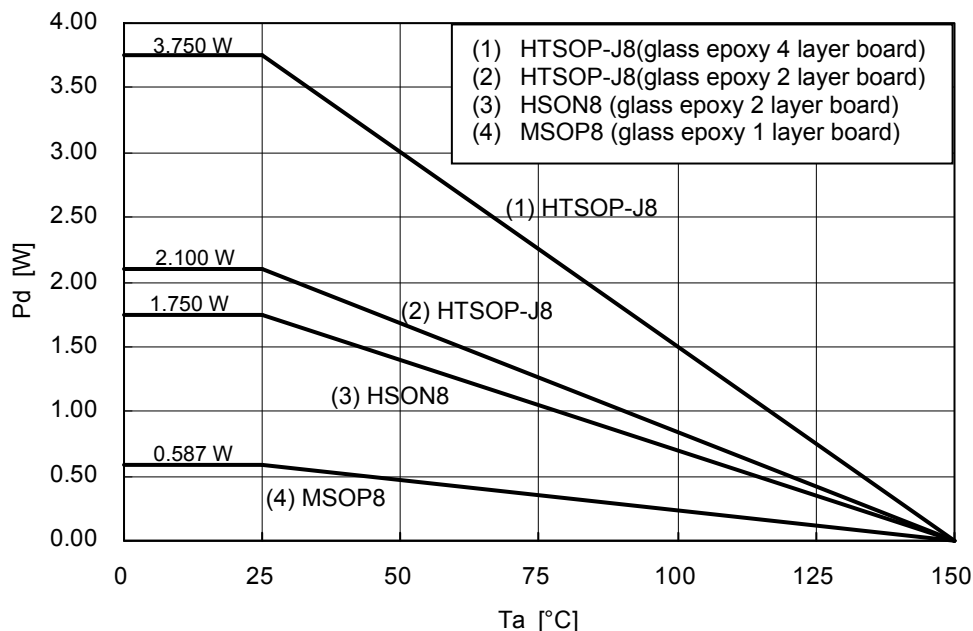
| Parameter         | Symbol   | Rating  | Unit |
|-------------------|----------|---------|------|
| Operating voltage | $V_{DD}$ | 4 to 18 | V    |

(1) However,  $V_{DD} \geq V_{IN}$ (2) However, exceed neither  $P_d$  nor ASO.

(3) Because of overcurrent protection circuit. (Refer to P11 Figure 20)

(4) IC mounted on ROHM standard board (70×70×1.6[mm], copper area 70×70[mm], glass epoxy 2 layer board).  
Derate by 16.8mW above 25°C(5) IC mounted on ROHM standard board (70×70×1.6[mm], copper area 70×70[mm], glass epoxy 2 layer board).  
Derate by 14.0mW above 25°C(6) IC mounted on ROHM standard board (70×70×1.6[mm], copper area 70×70[mm], glass epoxy 1 layer board).  
Derate by 4.7mW above 25°C.

## Heat Dissipation Characteristic



(HTSOP-J8) (1)IC mounted on ROHM standard board (70×70×1.6[mm], copper area 70×70[mm], glass epoxy 4 layer board). Derate by 30mW/°C above 25°C.

(2)IC mounted on ROHM standard board (70×70×1.6[mm], copper area 70×70[mm], glass epoxy 2 layer board). Derate by 16.8mW/°C above 25°C.

(HSON 8) (3)IC mounted on ROHM standard board (70×70×1.6[mm], copper area 70×70[mm], glass epoxy 2 layer board). Derate by 14.0mW/°C above 25°C.

(MSOP 8) (4)IC mounted on ROHM standard board (70×70×1.6[mm],copper area 70×70[mm], glass epoxy 1 layer board). Derate by 4.7mW/°C above 25°C.

Electrical Characteristics (unless otherwise specified,  $V_{DD}=4V$  to  $18V$ ,  $-40^{\circ}C \leq T_j \leq +150^{\circ}C$ )

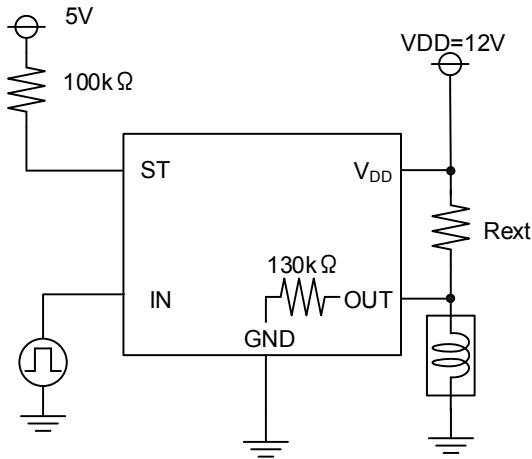
| Parameter                               |                       | Symbol           | Target value |      |      | Unit                                                                                 | Conditions                                 |
|-----------------------------------------|-----------------------|------------------|--------------|------|------|--------------------------------------------------------------------------------------|--------------------------------------------|
|                                         |                       |                  | Min          | Typ  | Max  |                                                                                      |                                            |
| [Power Supply Block]                    |                       |                  |              |      |      |                                                                                      |                                            |
| Standby current                         | I <sub>DDS1</sub>     | -                | 0.1          | 10   | μA   | V <sub>DD</sub> =12V,V <sub>IN</sub> =0V, V <sub>OUT</sub> =0V,T <sub>j</sub> =25°C  |                                            |
|                                         | I <sub>DDS2</sub>     | -                | -            | 220  | μA   | V <sub>DD</sub> =12V,V <sub>IN</sub> =0V, V <sub>OUT</sub> =0V,T <sub>j</sub> =150°C |                                            |
| Operating current                       | I <sub>DD</sub>       | -                | 1.5          | 3.0  | mA   | V <sub>DD</sub> =12V,V <sub>IN</sub> =5V, V <sub>OUT</sub> =open                     |                                            |
| Under Voltage Lock Out (UVLO) Threshold | V <sub>UVLO</sub>     | -                | 3.0          | 3.6  | V    |                                                                                      |                                            |
| [Input Block]                           |                       |                  |              |      |      |                                                                                      |                                            |
| H level input voltage                   | V <sub>IN(H)</sub>    | 3.0              | -            | -    | V    |                                                                                      |                                            |
| L level input voltage                   | V <sub>IN(L)</sub>    | -                | -            | 1.0  | V    |                                                                                      |                                            |
| Input hysteresis                        | V <sub>IN(HYS)</sub>  | -                | 0.3          | -    | V    |                                                                                      |                                            |
| H level input current                   | I <sub>IN(H)</sub>    | -                | 50           | 100  | μA   | V <sub>IN</sub> =5V                                                                  |                                            |
| L level input current                   | I <sub>IN(L)</sub>    | -10              | -            | 10   | μA   | V <sub>IN</sub> =0V                                                                  |                                            |
| [Power MOS Output]                      |                       |                  |              |      |      |                                                                                      |                                            |
| Output ON resistance                    | R <sub>DS(ON)</sub>   | -                | 500          | 650  | mΩ   | V <sub>DD</sub> =12V,I <sub>OUT</sub> =0.25A,T <sub>j</sub> =25°C                    |                                            |
|                                         | R <sub>DS(ON)</sub>   | -                | 900          | 1200 | mΩ   | V <sub>DD</sub> =12V,I <sub>OUT</sub> =0.25A,T <sub>j</sub> =150°C                   |                                            |
| Output leak current                     | I <sub>L(OFF)</sub>   | -                | -            | 5    | μA   | V <sub>IN</sub> =0V, T <sub>j</sub> =25°C                                            |                                            |
|                                         | I <sub>L(OFF)</sub>   | -                | -            | 200  | μA   | V <sub>IN</sub> =0V, T <sub>j</sub> =150°C                                           |                                            |
| Switching time                          | t <sub>ON</sub>       | -                | 13           | 25   | μs   | V <sub>DD</sub> =12V ,R <sub>L</sub> =47Ω,T <sub>j</sub> =25°C<br>Figure16           |                                            |
|                                         | t <sub>OFF</sub>      | -                | 9            | 25   | μs   | V <sub>DD</sub> =12V ,R <sub>L</sub> =47Ω,T <sub>j</sub> =25°C<br>Figure16           |                                            |
| Slew rate on                            | dV/dt <sub>ON</sub>   | -                | 3            | 6    | V/μs | V <sub>DD</sub> =12V ,R <sub>L</sub> =47Ω,T <sub>j</sub> =25°C<br>Figure16           |                                            |
| Slew rate off                           | -dV/dt <sub>OFF</sub> | -                | 3            | 6    | V/μs | V <sub>DD</sub> =12V ,R <sub>L</sub> =47Ω,T <sub>j</sub> =25°C<br>Figure16           |                                            |
| Output clamp voltage                    | V <sub>CL</sub>       | -8               | -6.0         | -4.5 | V    | V <sub>IN</sub> =0V,I <sub>OUT</sub> =100mA<br>Figure17                              |                                            |
| [Diagnostic Output]                     |                       |                  |              |      |      |                                                                                      |                                            |
| Diagnostic output voltage               | “L” level             | V <sub>STL</sub> | -            | -    | 0.4  | V                                                                                    | V <sub>IN</sub> =5V,I <sub>ST</sub> =0.1mA |
| Diagnostic output current               | “H” level             | I <sub>STH</sub> | -            | -    | 10   | μA                                                                                   | V <sub>IN</sub> =0V,V <sub>ST</sub> =12V   |

Electrical Characteristics (unless otherwise specified,  $V_{DD}=4V$  to  $18V$ ,  $-40^{\circ}C \leq T_j \leq 150^{\circ}C$ )

| Parameter                         |     | Symbol            | Target value |      |      | Unit | Conditions                                              |
|-----------------------------------|-----|-------------------|--------------|------|------|------|---------------------------------------------------------|
|                                   |     |                   | Min          | Typ  | Max  |      |                                                         |
| [Protect Circuit]                 |     |                   |              |      |      |      |                                                         |
| Overcurrent protection            |     | I <sub>LIM</sub>  | 0.8          | 1.45 | 2.0  | A    |                                                         |
| Diagnostic output delay time(OCP) | ON  | t <sub>DHL</sub>  | -            | 20   | 100  | μs   | Diagnostic output delay time(OCP) Figure20              |
|                                   | OFF | t <sub>DLH</sub>  | -            | 100  | 200  | μs   | V <sub>DD</sub> =12V, R <sub>L</sub> =∞ to 4Ω Figure 20 |
| Open Load Detection threshold (1) |     | V <sub>OPEN</sub> | 1.3          | 2.8  | 4.0  | V    | V <sub>IN</sub> =0V                                     |
| Open Load Detection delay time    |     | T <sub>OPEN</sub> | 100          | 300  | 1000 | μs   | V <sub>IN</sub> =5V to 0V Figure21                      |

(1) In order to detect the voltage, an external resistance ( $R_{ext}$ ) of  $130k\Omega$  (Typ) is required between  $V_{DD}$  and OUT pins. At worst condition, the following resistance is recommended.

| $V_{DD}$ | $R_{ext}$          |
|----------|--------------------|
| 12 V     | Under $200k\Omega$ |
| 6 V      | Under $50k\Omega$  |
| 5 V      | Under $25k\Omega$  |



Terms

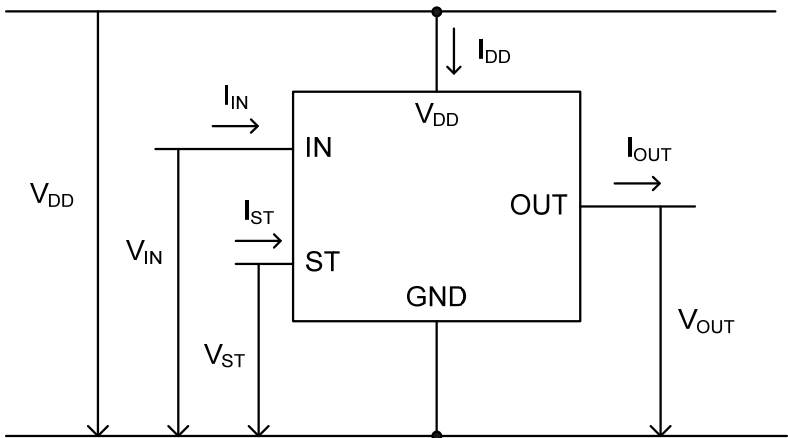


Figure 1. Terms

## Measuring circuit

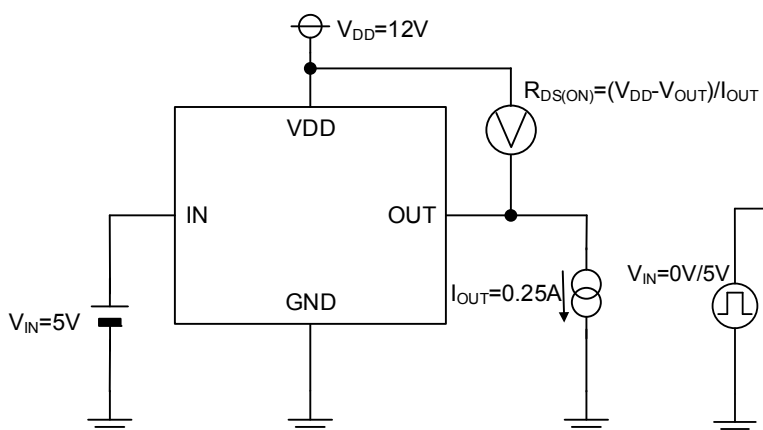
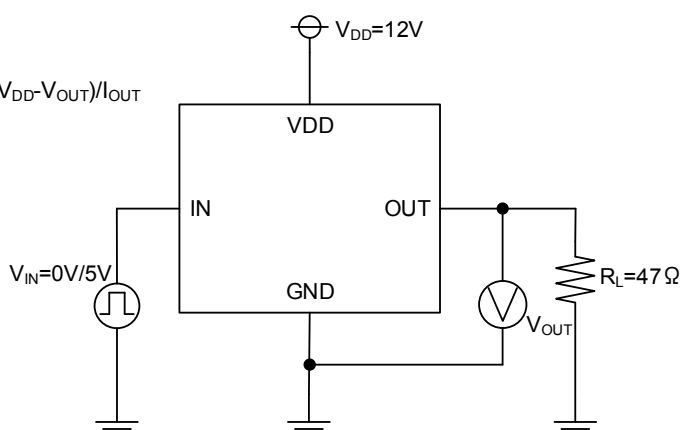
Figure 2.  $R_{ON}$  measuring circuit

Figure 3. Switching time measuring circuit

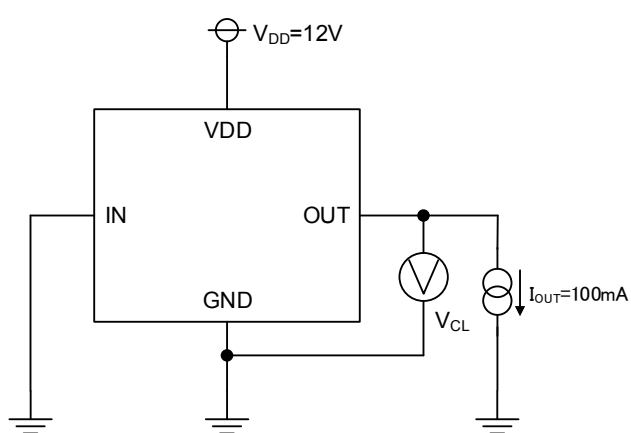


Figure 4. Output clamp voltage measuring circuit

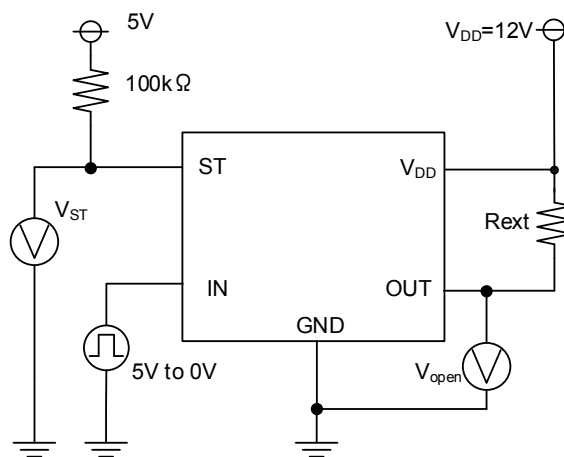


Figure 5. Open Load Detection threshold measuring circuit

Diagnostic Output Truth Table

| V <sub>IN</sub> | T <sub>j</sub>               | OUTPUT                |                               | Mode                | V <sub>ST</sub> | Output state       |
|-----------------|------------------------------|-----------------------|-------------------------------|---------------------|-----------------|--------------------|
|                 |                              | V <sub>OUT</sub>      | I <sub>OUT</sub>              |                     |                 |                    |
| H               | T <sub>j</sub> ≤ 175°C (Typ) | -                     | I <sub>OUT</sub> < 1.45A(Typ) | Normal              | H               | ON                 |
|                 |                              |                       | I <sub>OUT</sub> ≥ 1.45A(Typ) | Overcurrent protect | L               | OFF <sup>(1)</sup> |
|                 | T <sub>j</sub> > 175°C (Typ) | -                     | -                             | Overheating protect | L               | OFF <sup>(1)</sup> |
| L               | -                            | H<br>(Over 2.8V(Typ)) | -                             | Open protect        | L               | OFF <sup>(1)</sup> |
|                 |                              | L                     | -                             | Stand by            | H               | OFF <sup>(1)</sup> |

(1)OFF : 130kΩ (Typ) is built in between OUT and GND.

Typical Performance Curves (unless otherwise specified,  $V_{DD}=12V$ ,  $V_{IN}=5V$ ,  $T_J=25^\circ C$ )

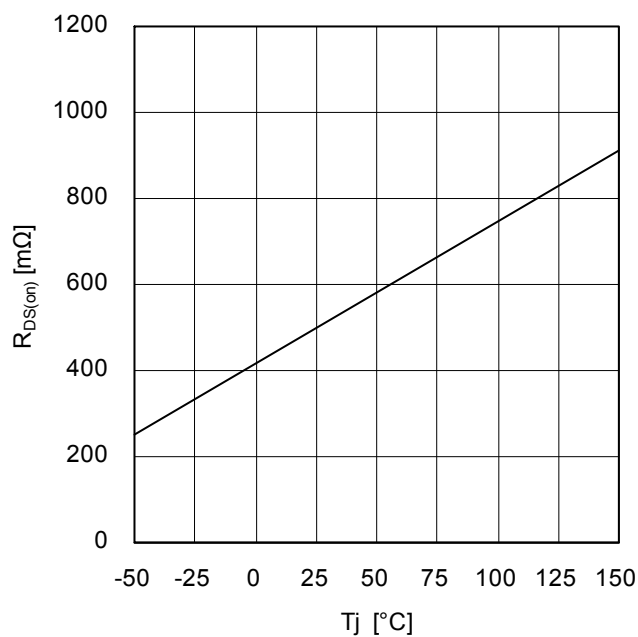


Figure 6. Output ON Resistance Characteristic [temperature characteristic]

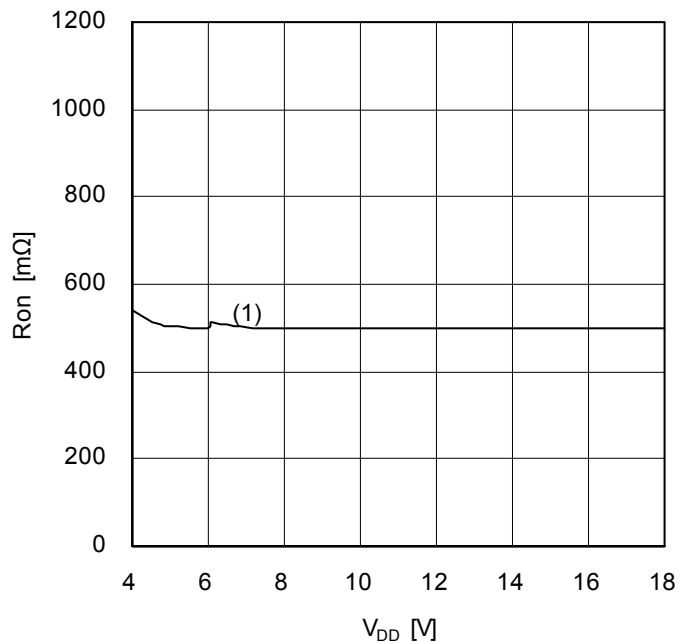


Figure 7. Output ON Resistance Characteristic [Power supply voltage characteristic]

(1) Since the reference voltage of a charge pump circuit changes at the time of reduced voltage, ON resistance changes about 3% in the 6.5V neighborhood.

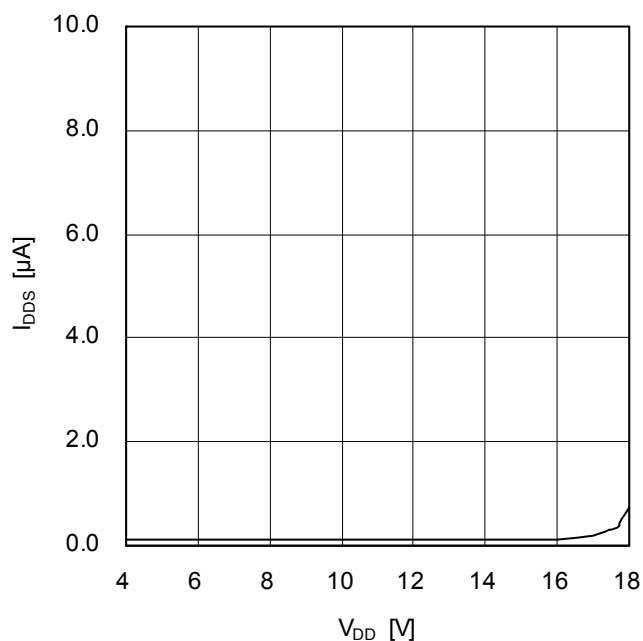


Figure 8. Standby Current Characteristic ( $V_{IN}=0V$ )

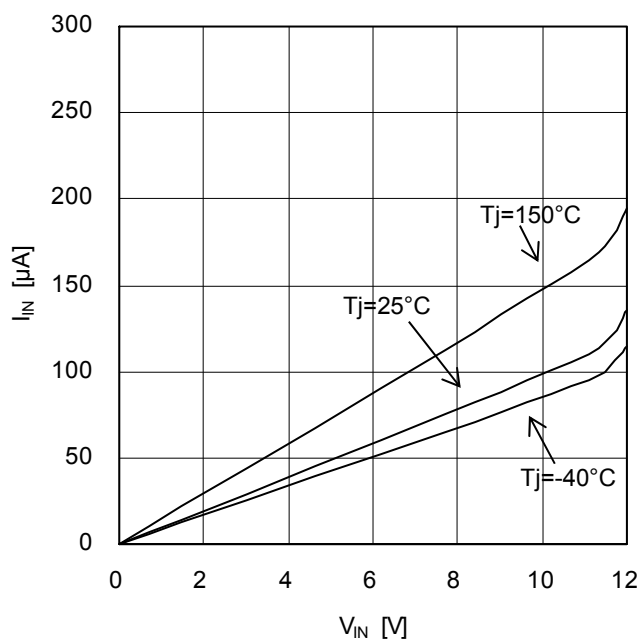


Figure 9. Input Current Characteristic

Typical Performance Curves (unless otherwise specified,  $V_{DD}=12V$ ,  $V_{IN}=5V$ ,  $T_J=25^{\circ}C$ )

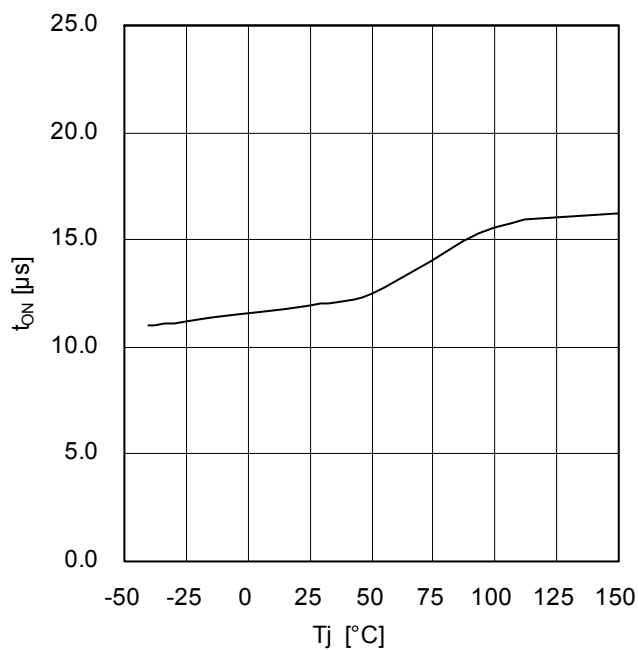


Figure 10. Switching Time ( $t_{ON}$ )[temperature characteristic]

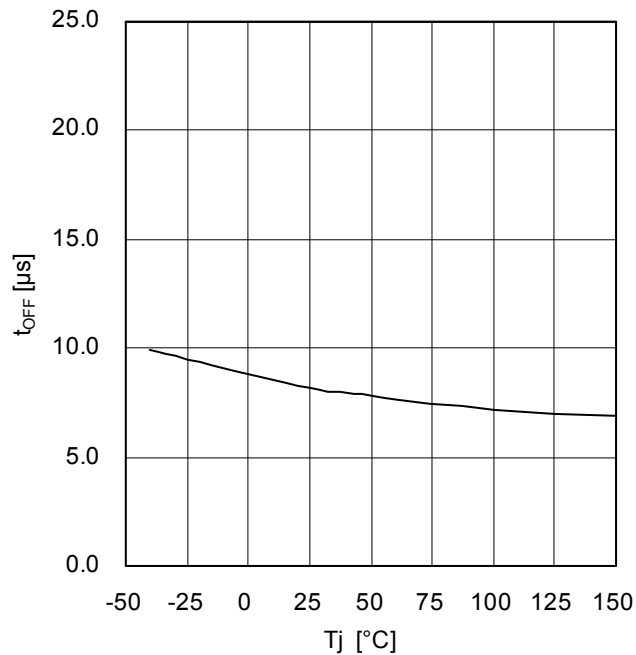


Figure 11. Switching Time ( $t_{OFF}$ )[temperature characteristic]

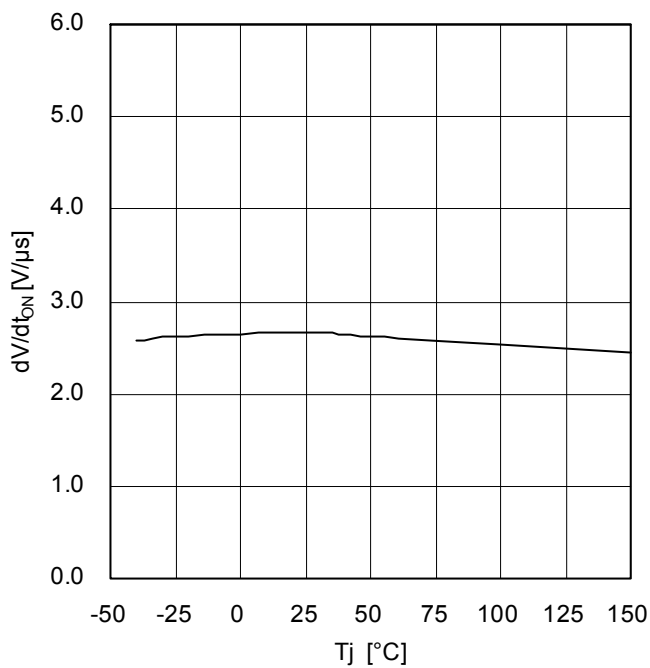


Figure 12. Slew Rate ON [temperature characteristic]

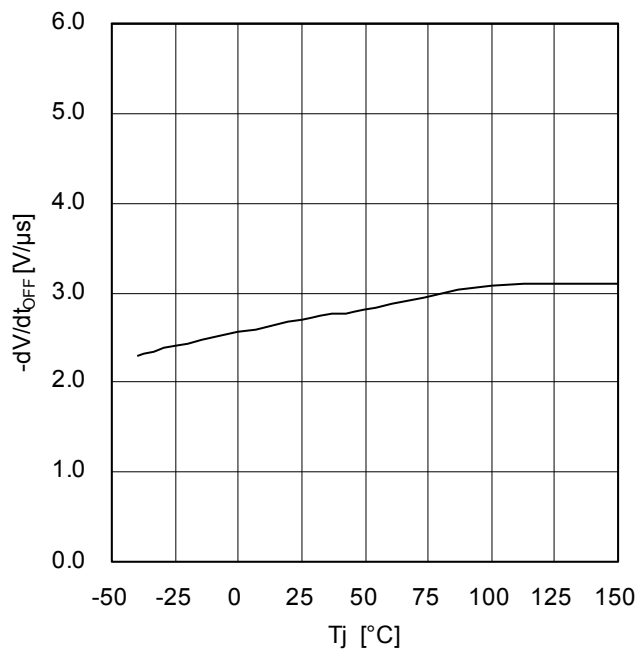


Figure 13. Slew Rate OFF [temperature characteristic]

Typical Performance Curves (unless otherwise specified,  $V_{DD}=12V$ ,  $V_{IN}=5V$ ,  $T_j=25^\circ C$ )

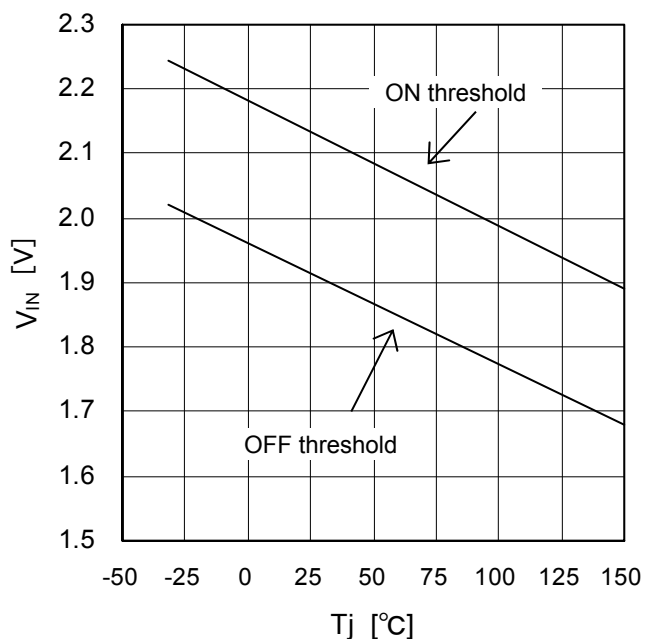


Figure 14. Input Voltage Threshold Characteristic

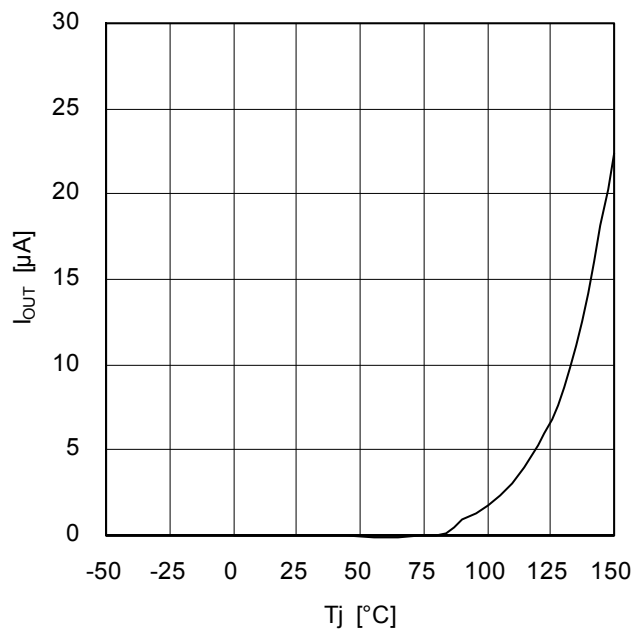


Figure 15. Output Leak Current [temperature characteristic] ( $V_{IN}=0V$ )

#### Switching time measuring

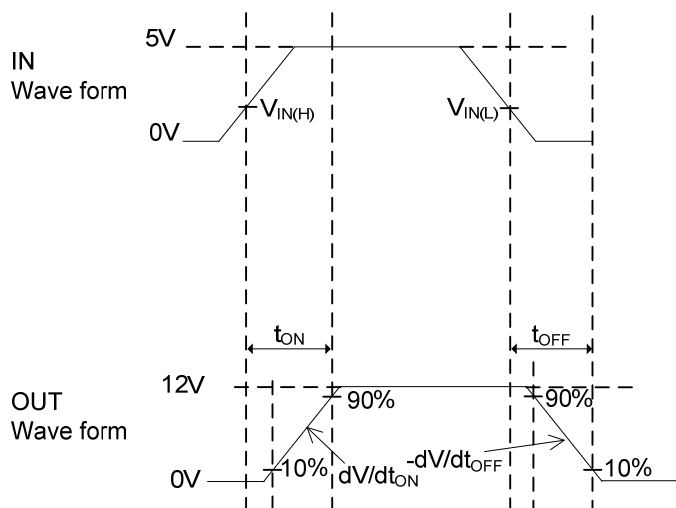


Figure 16. Switching time

#### Active clamp energy timing chart

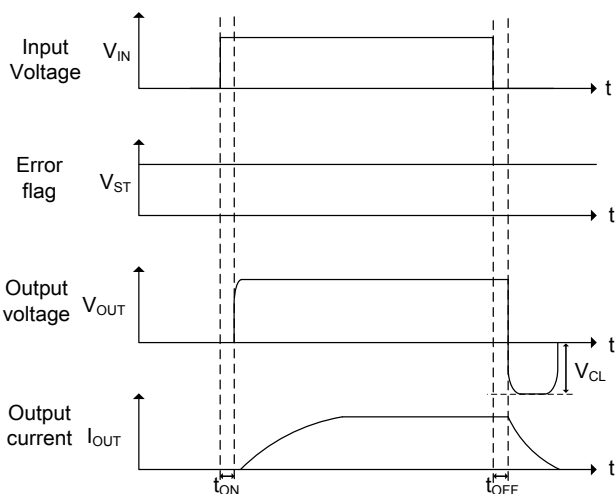


Figure 17. Active Clamp Energy Timing Chart

Protect function timing chart

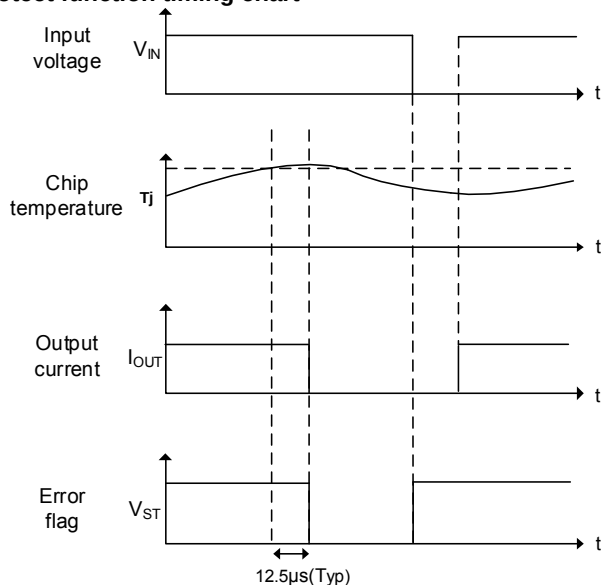


Figure 18. BD1HC500 Off-latch Overheat Protection Timing Chart

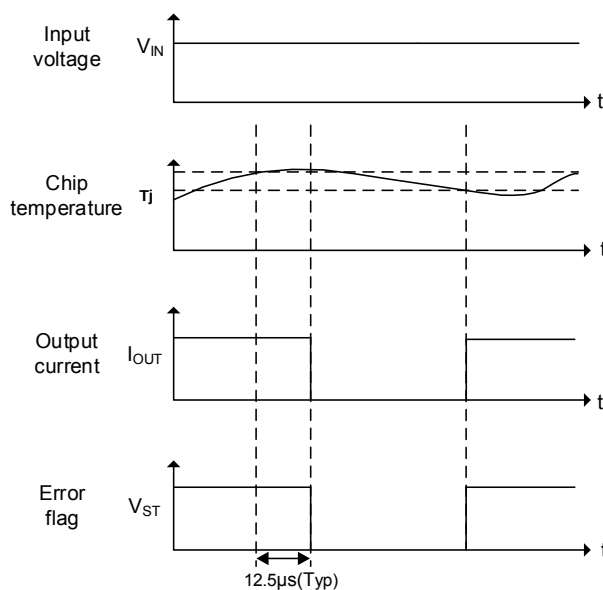


Figure 19. BD1HD500 Self-restart Overheat Protection Timing Chart

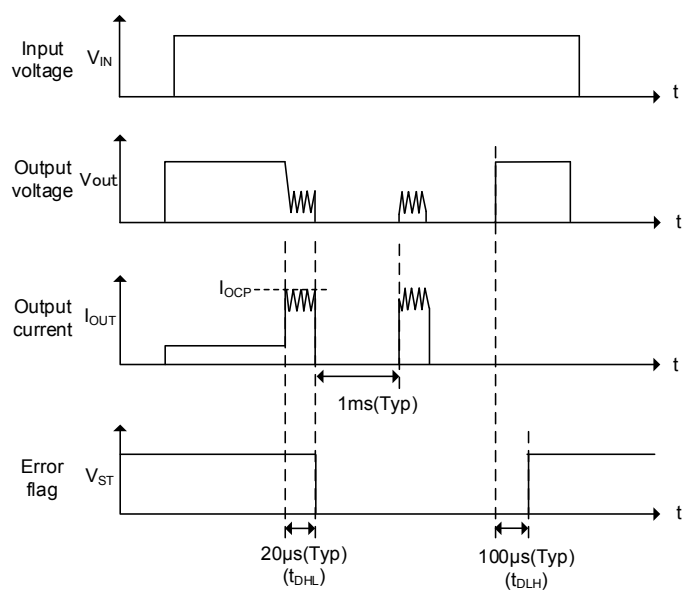


Figure 20. Overcurrent Protect Timing Chart

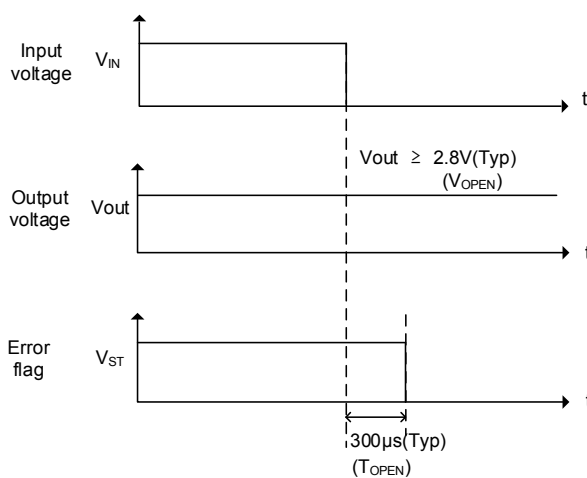
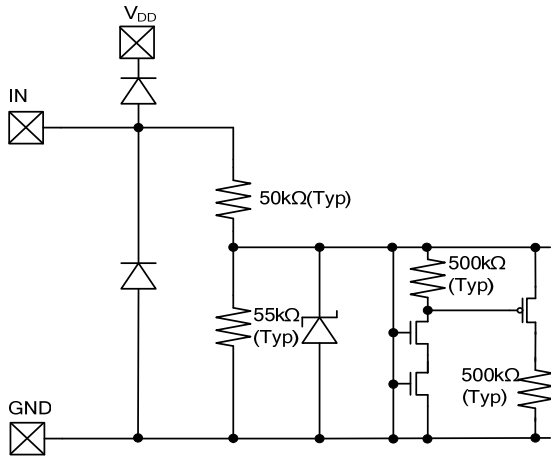
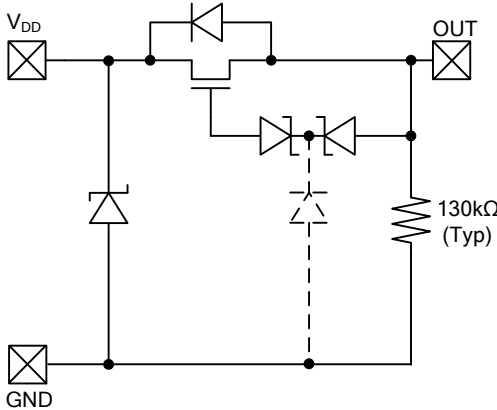
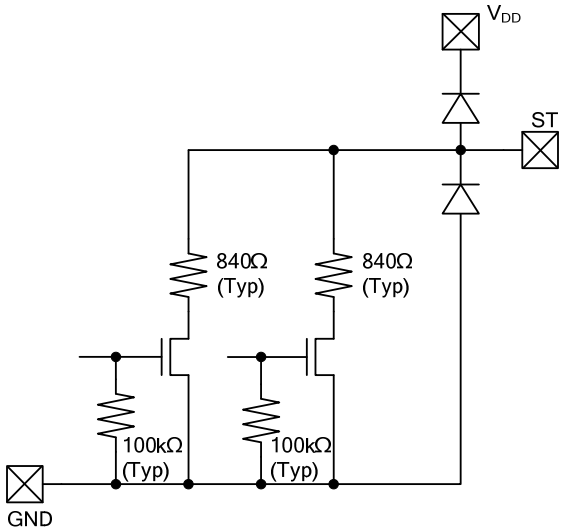


Figure 21. Open Load Detection Timing Chart

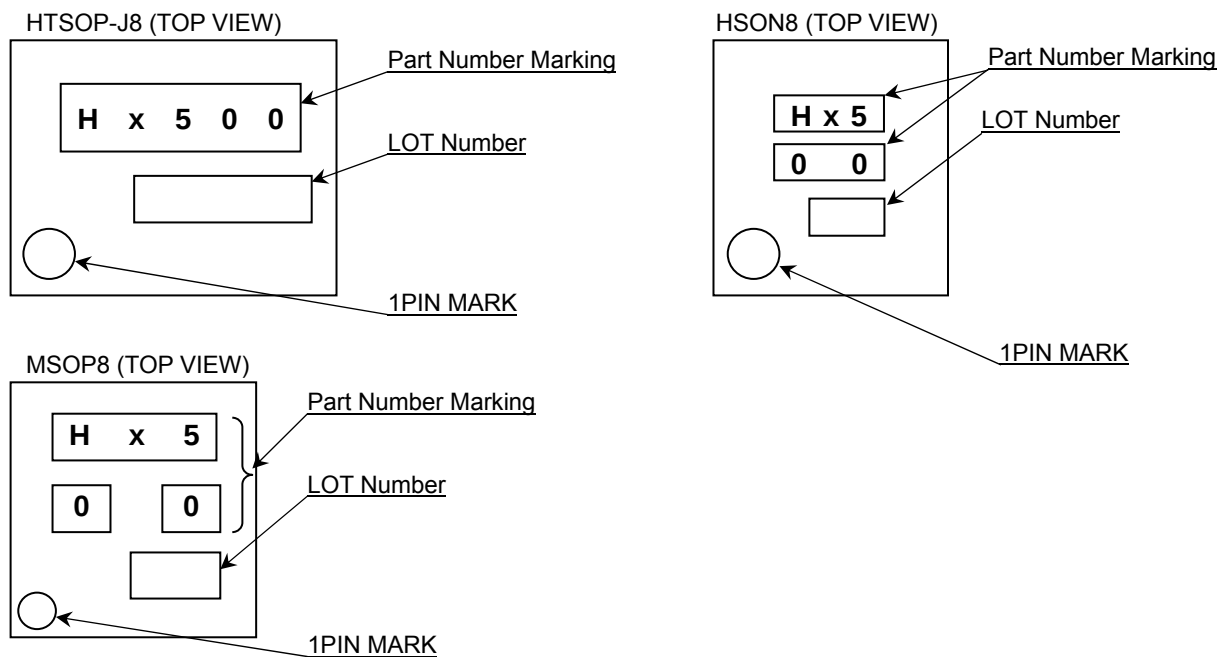
I/O equivalence circuits

| Pin          | Symbol     | I/O equivalence circuits                                                             |
|--------------|------------|--------------------------------------------------------------------------------------|
| 1            | IN         |    |
| 2            | GND        |                                                                                      |
| 3, 4<br>5, 6 | OUT<br>VDD |   |
| 8            | ST         |  |
| Cooling Tab  | TAB        |                                                                                      |

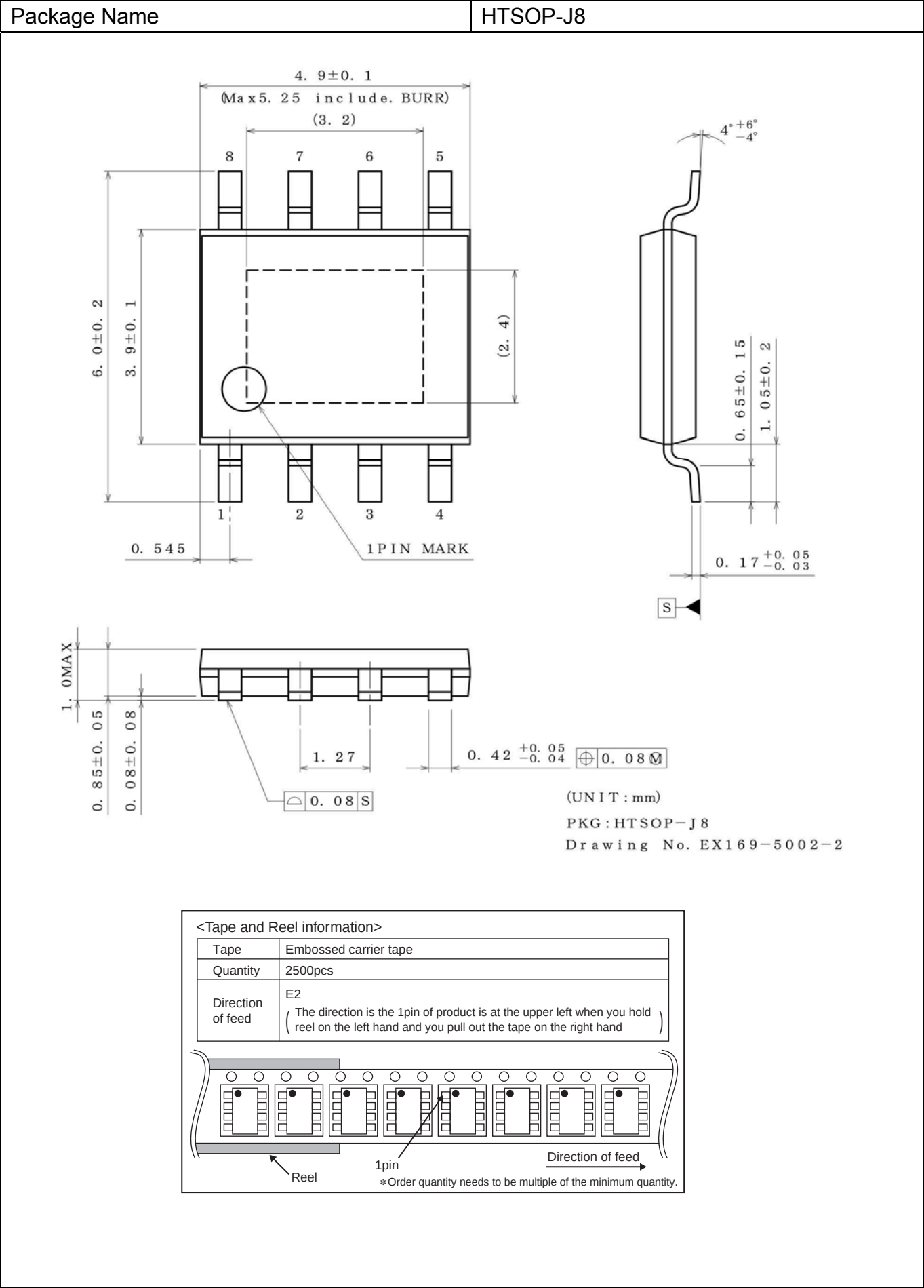
## Ordering Information

|                                                 |                                                  |                                                                                                                                                          |
|-------------------------------------------------|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| B D 1 H x 5 0 0 F V M                           | -                                                | CTR                                                                                                                                                      |
| Series<br>C:TSD Off-latch<br>D:TSD Self-restart | PKG<br>EFJ: HTSOP-J8<br>HFN: HSON8<br>FVM: MSOP8 | Packaging and forming specification<br>E2: Embossed tape and reel<br>(HTSOP-J8)<br>TR: Embossed tape and reel<br>(MSOP 8, HSON 8)<br>C: High reliability |

## Marking Diagram

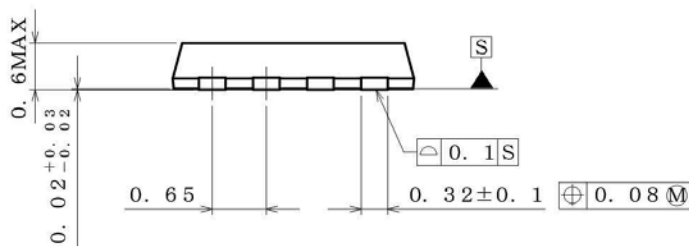
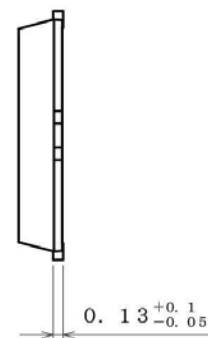
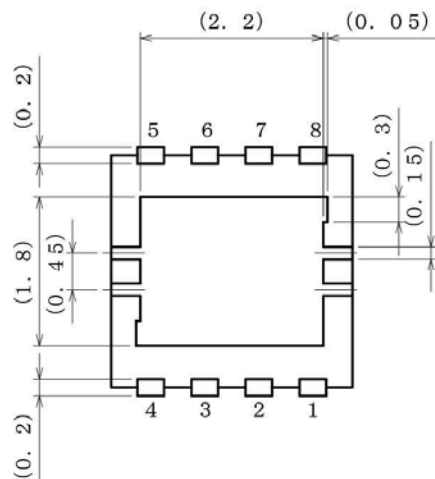
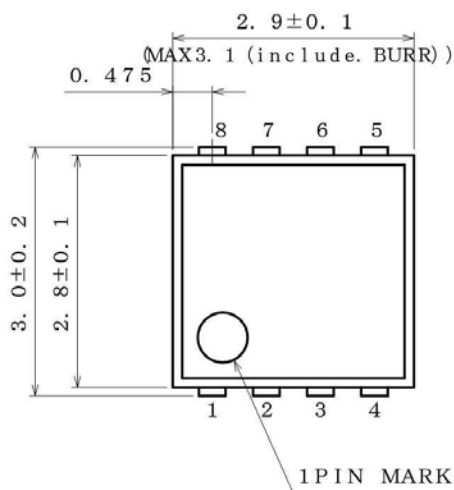


Physical Dimension Tape and Reel Information



Package Name

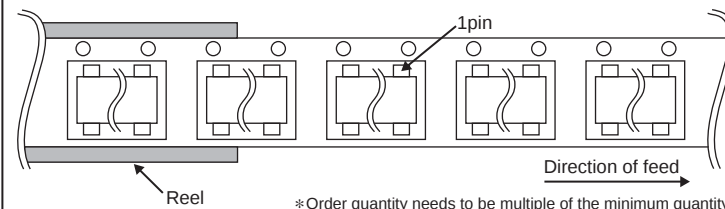
HSO8



(UNIT : mm)  
 PKG : HSO8  
 Drawing No. EX163-5002

## &lt;Tape and Reel information&gt;

|                   |                                                                                                                                                    |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Tape              | Embossed carrier tape                                                                                                                              |
| Quantity          | 3000pcs                                                                                                                                            |
| Direction of feed | TR<br>(The direction is the 1pin of product is at the upper right when you hold reel on the left hand and you pull out the tape on the right hand) |

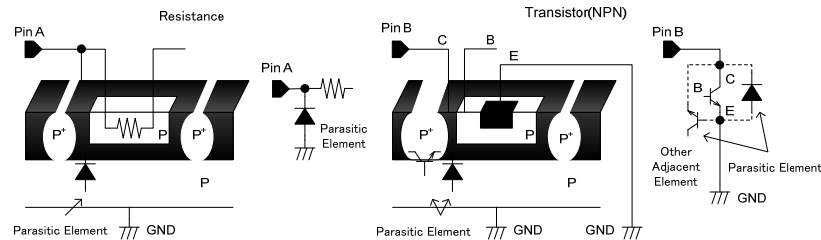


\* Order quantity needs to be multiple of the minimum quantity.



## Operational Notes

- 1) Absolute Maximum Ratings  
Operating the IC over the absolute maximum ratings may damage the IC. In addition, it is impossible to predict all destructive situations such as short-circuit modes or open circuit modes. Therefore, it is important to consider circuit protection measures, like adding a fuse, in case the IC is expected to be operated in a special mode exceeding the absolute maximum ratings.
- 2) Reverse connection of power supply  
Connecting the power supply in reverse polarity can damage the IC. Take precautions against reverse polarity when connecting the power supply, such as mounting an external diode between the power supply and the IC's power supply terminals.
- 3) Power supply line  
Design the PCB layout pattern to provide low impedance ground and supply lines. Separate the ground and supply lines of the digital and analog blocks to prevent noise in the ground and supply lines of the digital block from affecting the analog block. Furthermore, connect a capacitor to ground at all power supply pins. Consider the effect of temperature and aging on the capacitance value when using electrolytic capacitors.
- 4) GND voltage  
The voltage of the ground pin must be the lowest voltage of all pins of the IC at all operating conditions. Ensure that no pins are at a voltage below the ground pin at any time, even during transient condition.
- 5) Thermal consideration  
Use a thermal design that allows for a sufficient margin by taking into account the permissible power dissipation (Pd) in actual operating conditions.
- 6) Short between pins and mounting errors  
Be careful when mounting the IC on printed circuit boards. The IC may be damaged if it is mounted in a wrong orientation or if pins are shorted together. Short circuit may be caused by conductive particles caught between the pins.
- 7) TSD (Thermal Shut Down)  
The IC incorporates a built-in thermal shutdown circuit, which is designed to turn off the IC when the internal temperature of the IC reaches a 175°C (with 25°C hysteresis). It is not designed to protect the IC from damage or guarantee its operation. Do not continue to operate the IC after this function is activated. Do not use the IC in conditions where this function will always be activated.
- 8) Overcurrent protection circuit (OCP)  
The IC incorporates an over-current protection circuit that operates in accordance with the rated output capacity. This circuit protects the IC from damage when the load becomes shorted. It is also designed to limit the output current (without latching) in the event of more than 1.45A (Typ) current flow, such as from a large capacitor or other component connected to the output pin. This protection circuit is effective in preventing damage to the IC in cases of sudden and unexpected current surges. The IC should not be used in applications where the over current protection circuit will be activated continuously.  
ST (8 PIN) will be set to 'L (abnormal condition)' if the current limit state continues to 20μs(Typ). Then, ST (8 PIN) will be set to 'H (normal condition)' if the current limit release until 1.1ms(Typ).  
If current limit state continues, generation of heat, degradation, etc. of the IC can be considered. When the state of overcurrent still flows, compensate by setting the IC in standby mode applications using ST (8 PIN).
- 9) Testing on application boards  
When testing the IC on an application board, connecting a capacitor directly to a low-impedance output pin may subject the IC to stress. Always discharge capacitors completely after each process or step. The IC's power supply should always be turned off completely before connecting or removing it from the test setup during the inspection process. To prevent damage from static discharge, ground the IC during assembly and use similar precautions during transport and storage.
- 10) Regarding input pins of the IC  
This monolithic IC contains P<sup>+</sup> isolation and P substrate layers between adjacent elements in order to keep them isolated. P-N junctions are formed at the intersection of the P layers with the N layers of other elements, creating a parasitic diode or transistor. For example (refer to figure below):  
When GND > Pin A and GND > Pin B, the P-N junction operates as a parasitic diode.  
When GND > Pin B, the P-N junction operates as a parasitic transistor.  
Parasitic diodes inevitably occur in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits, operational faults, or physical damage. Therefore, conditions that cause these diodes to operate, such as applying a voltage lower than the GND voltage to an input pin (and thus to the P substrate) should be avoided.



## 11) FIN (HTSOP-J8, HSON 8)

Since it has connected with sub of IC, please connect the heat dissipation metal to external GND potential.

## Status of this document

The Japanese version of this document is the formal datasheet. A customer may use this translation version only as reference to help understand the formal version. If there are any differences, the formal version takes precedence.

## Revision History

| Date        | Revision | Changes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20.Sep.2013 | 001      | New Release                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 15.Apr.2015 | 002      | <ul style="list-style-type: none"> <li>• P1. "AEC-Q100 qualified" is added in Features</li> <li>• P1. "Product Summary" modify</li> <li>• P1. Typical Application Circuit change from "V<sub>DD</sub>" to "VBAT"</li> <li>• P2. Pin Descriptions change from "FIN" to "Cooling Tab" and add Note(1)</li> <li>• P3. Absolute Maximum Ratings delete "Ta"</li> <li>• P3. Operating Voltage Ratings change Note(1) content</li> <li>• P5. Electrical Characteristics modify circuit figure of "Note(1)"</li> <li>• P7. Diagnostic Output Truth Table modify</li> <li>• P11 . Change from "μsec" to "μs" at Protect function timing chart</li> <li>• P12 . I/O equivalence circuits add "Cooling Tab"</li> </ul> |

# Notice

## Precaution on using ROHM Products

1. If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment <sup>(Note 1)</sup>, aircraft/spacecraft, nuclear power controllers, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

| JAPAN     | USA       | EU         | CHINA     |
|-----------|-----------|------------|-----------|
| CLASS III | CLASS III | CLASS II b | CLASS III |
| CLASS IV  |           | CLASS III  |           |

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
  - [a] Installation of protection circuits or other protective devices to improve system safety
  - [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure
3. Our Products are not designed under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
  - [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
  - [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
  - [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>
  - [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
  - [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
  - [f] Sealing or coating our Products with resin or other coating materials
  - [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
  - [h] Use of the Products in places subject to dew condensation
4. The Products are not subject to radiation-proof design.
5. Please verify and confirm characteristics of the final or mounted products in using the Products.
6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.
7. De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.
8. Confirm that operation temperature is within the specified range described in the product specification.
9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

## Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.
2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

## Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.
2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

## Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of ionizer, friction prevention and temperature / humidity control).

## Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
  - [a] the Products are exposed to sea winds or corrosive gases, including Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>
  - [b] the temperature or humidity exceeds those recommended by ROHM
  - [c] the Products are exposed to direct sunshine or condensation
  - [d] the Products are exposed to high Electrostatic
2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.
3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.
4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

## Precaution for Product Label

QR code printed on ROHM Products label is for ROHM's internal use only.

## Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

## Precaution for Foreign Exchange and Foreign Trade act

Since concerned goods might be fallen under listed items of export control prescribed by Foreign exchange and Foreign trade act, please consult with ROHM in case of export.

## Precaution Regarding Intellectual Property Rights

1. All information and data including but not limited to application example contained in this document is for reference only. ROHM does not warrant that foregoing information or data will not infringe any intellectual property rights or any other rights of any third party regarding such information or data.
2. ROHM shall not have any obligations where the claims, actions or demands arising from the combination of the Products with other articles such as components, circuits, systems or external equipment (including software).
3. No license, expressly or implied, is granted hereby under any intellectual property rights or other rights of ROHM or any third parties with respect to the Products or the information contained in this document. Provided, however, that ROHM will not assert its intellectual property rights or other rights against you or your customers to the extent necessary to manufacture or sell products containing the Products, subject to the terms and conditions herein.

## Other Precaution

1. This document may not be reprinted or reproduced, in whole or in part, without prior written consent of ROHM.
2. The Products may not be disassembled, converted, modified, reproduced or otherwise changed without prior written consent of ROHM.
3. In no event shall you use in any way whatsoever the Products and the related technical information contained in the Products or this document for any military purposes, including but not limited to, the development of mass-destruction weapons.
4. The proper names of companies or products described in this document are trademarks or registered trademarks of ROHM, its affiliated companies or third parties.

**General Precaution**

1. Before you use our Products, you are requested to carefully read this document and fully understand its contents. ROHM shall not be in any way responsible or liable for failure, malfunction or accident arising from the use of any ROHM's Products against warning, caution or note contained in this document.
2. All information contained in this document is current as of the issuing date and subject to change without any prior notice. Before purchasing or using ROHM's Products, please confirm the latest information with a ROHM sales representative.
3. The information contained in this document is provided on an "as is" basis and ROHM does not warrant that all information contained in this document is accurate and/or error-free. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties resulting from inaccuracy or errors of or concerning such information.



## BD1HC500EFJ-C - Web Page

[Distribution Inventory](#)

|                             |               |
|-----------------------------|---------------|
| Part Number                 | BD1HC500EFJ-C |
| Package                     | HTSOP-J8      |
| Unit Quantity               | 2500          |
| Minimum Package Quantity    | 2500          |
| Packing Type                | Taping        |
| Constitution Materials List | inquiry       |
| RoHS                        | Yes           |