



# BSH111BK

55 V, N-channel Trench MOSFET

26 November 2014

Product data sheet

## 1. General description

N-channel enhancement mode Field-Effect Transistor (FET) in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

## 2. Features and benefits

- Low threshold voltage
- Very fast switching
- Trench MOSFET technology
- ElectroStatic Discharge (ESD) protection > 3 kV HBM

## 3. Applications

- Relay driver
- High-speed line driver
- Low-side loadswitch
- Switching circuits

## 4. Quick reference data

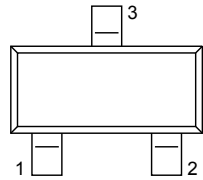
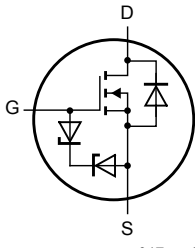
Table 1. Quick reference data

| Symbol                 | Parameter                        | Conditions                                                               |     | Min | Typ | Max | Unit |
|------------------------|----------------------------------|--------------------------------------------------------------------------|-----|-----|-----|-----|------|
| V <sub>DS</sub>        | drain-source voltage             | T <sub>j</sub> = 25 °C                                                   |     | -   | -   | 55  | V    |
| V <sub>GS</sub>        | gate-source voltage              |                                                                          |     | -10 | -   | 10  | V    |
| I <sub>D</sub>         | drain current                    | V <sub>GS</sub> = 4.5 V; T <sub>amb</sub> = 25 °C                        | [1] | -   | -   | 210 | mA   |
|                        |                                  | V <sub>GS</sub> = 4.5 V; T <sub>sp</sub> = 25 °C                         |     | -   | -   | 335 | mA   |
| Static characteristics |                                  |                                                                          |     |     |     |     |      |
| R <sub>DSon</sub>      | drain-source on-state resistance | V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 200 mA; T <sub>j</sub> = 25 °C |     | -   | 2.3 | 4   | Ω    |

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 1 cm<sup>2</sup>.

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline                                                                                    | Graphic symbol                                                                                   |
|-----|--------|-------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| 1   | G      | gate        | <br>TO-236AB (SOT23) | <br>017aaa255 |
| 2   | S      | source      |                                                                                                       |                                                                                                  |
| 3   | D      | drain       |                                                                                                       |                                                                                                  |

6. Ordering information

Table 3. Ordering information

| Type number | Package  |                                          |         |
|-------------|----------|------------------------------------------|---------|
|             | Name     | Description                              | Version |
| BSH111BK    | TO-236AB | plastic surface-mounted package; 3 leads | SOT23   |

7. Marking

Table 4. Marking codes

| Type number | Marking code<br><a href="#">[1]</a> |
|-------------|-------------------------------------|
| BSH111BK    | %4T                                 |

[1] % = placeholder for manufacturing site code

## 8. Limiting values

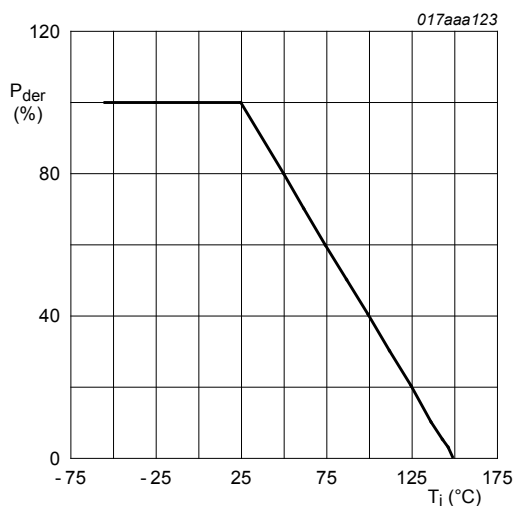
**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol                    | Parameter               | Conditions                                                     |     | Min | Max  | Unit |
|---------------------------|-------------------------|----------------------------------------------------------------|-----|-----|------|------|
| V <sub>DS</sub>           | drain-source voltage    | T <sub>j</sub> = 25 °C                                         |     | -   | 55   | V    |
| V <sub>GS</sub>           | gate-source voltage     |                                                                |     | -10 | 10   | V    |
| I <sub>D</sub>            | drain current           | V <sub>GS</sub> = 4.5 V; T <sub>amb</sub> = 25 °C              | [1] | -   | 210  | mA   |
|                           |                         | V <sub>GS</sub> = 4.5 V; T <sub>amb</sub> = 100 °C             | [1] | -   | 130  | mA   |
|                           |                         | V <sub>GS</sub> = 4.5 V; T <sub>sp</sub> = 25 °C               |     | -   | 335  | mA   |
| I <sub>DM</sub>           | peak drain current      | T <sub>amb</sub> = 25 °C; single pulse; t <sub>p</sub> ≤ 10 μs |     | -   | 0.85 | A    |
| P <sub>tot</sub>          | total power dissipation | T <sub>amb</sub> = 25 °C                                       | [2] | -   | 302  | mW   |
|                           |                         |                                                                | [1] | -   | 364  | mW   |
|                           |                         | T <sub>sp</sub> = 25 °C                                        |     | -   | 1449 | mW   |
| T <sub>j</sub>            | junction temperature    |                                                                |     | -55 | 150  | °C   |
| T <sub>amb</sub>          | ambient temperature     |                                                                |     | -55 | 150  | °C   |
| T <sub>stg</sub>          | storage temperature     |                                                                |     | -65 | 150  | °C   |
| <b>Source-drain diode</b> |                         |                                                                |     |     |      |      |
| I <sub>S</sub>            | source current          | T <sub>amb</sub> = 25 °C                                       | [1] | -   | 200  | mA   |

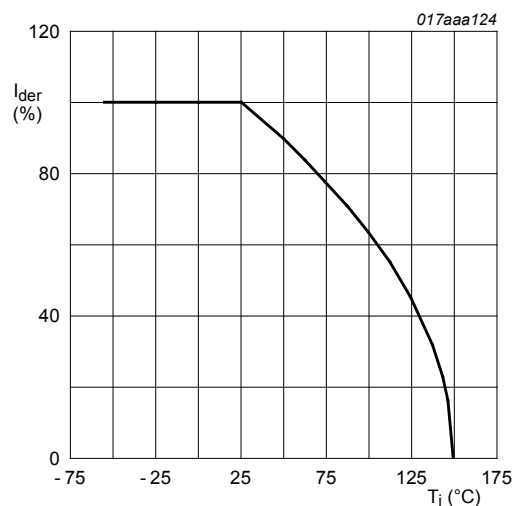
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 1 cm<sup>2</sup>.

[2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.



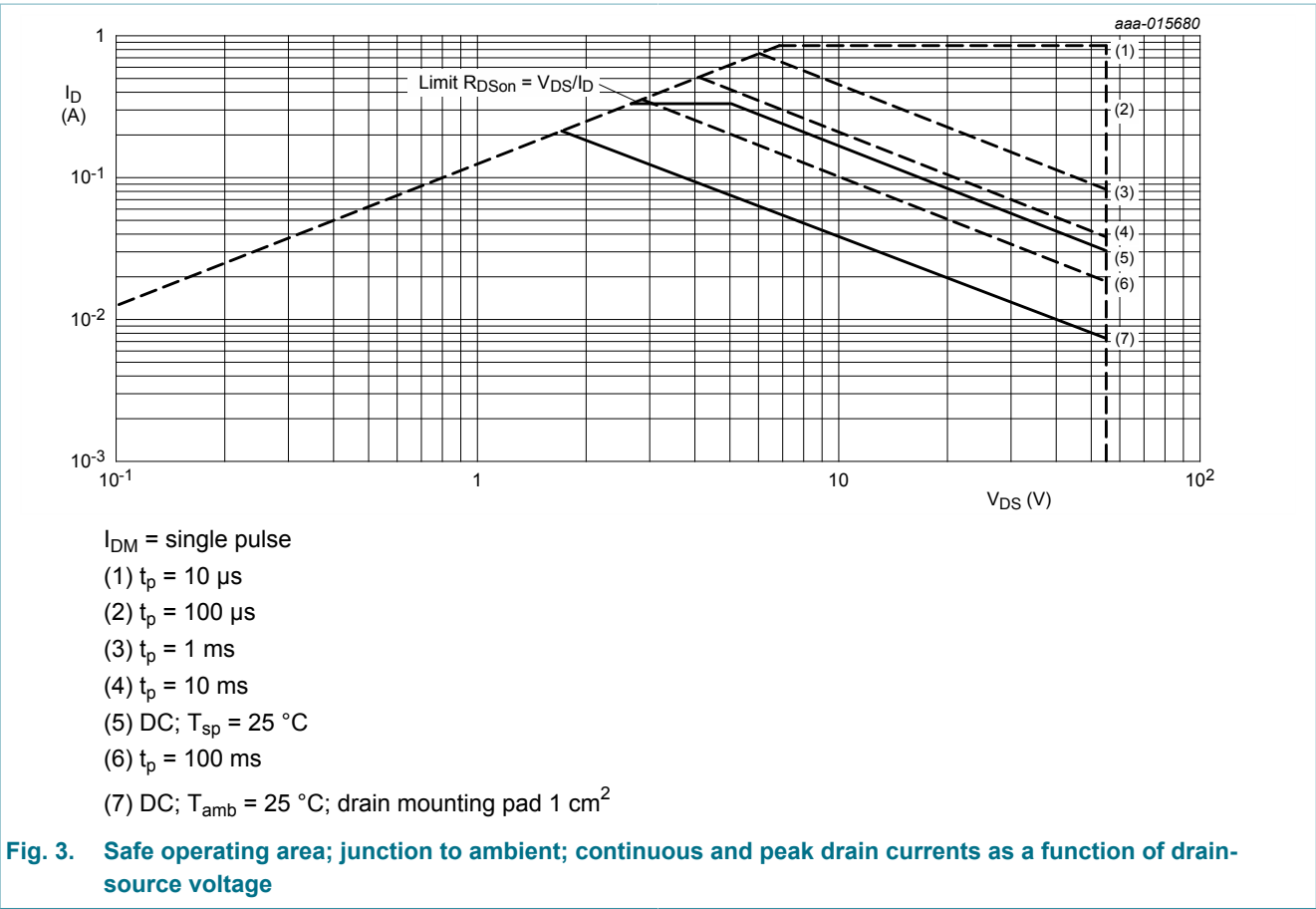
**Fig. 1. Normalized total power dissipation as a function of junction temperature**

$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}\text{C})}} \times 100 \%$$



**Fig. 2. Normalized continuous drain current as a function of junction temperature**

$$I_{der} = \frac{I_D}{I_{D(25^{\circ}\text{C})}} \times 100 \%$$



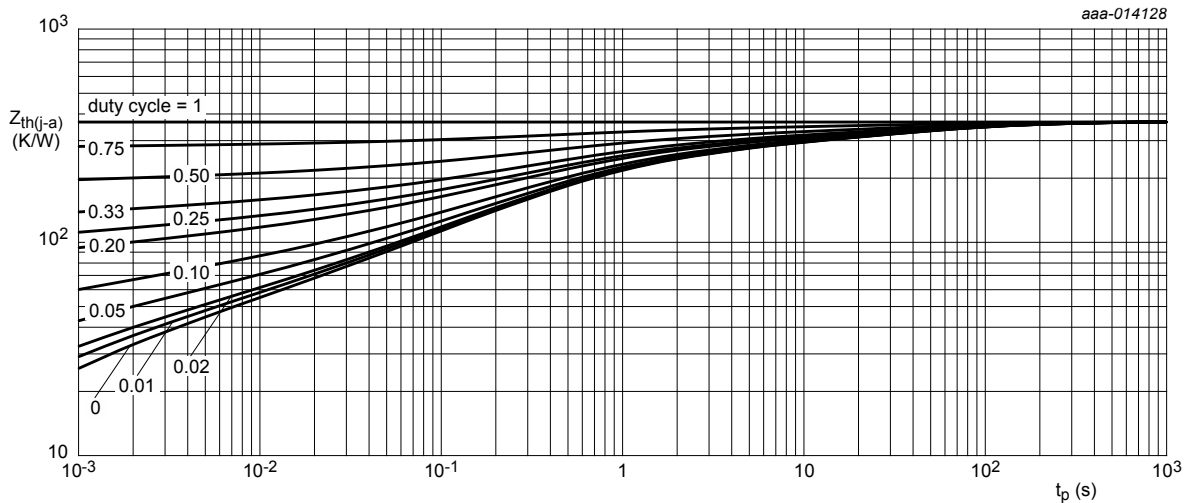
9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol         | Parameter                                        | Conditions  |     | Min | Typ | Max | Unit |
|----------------|--------------------------------------------------|-------------|-----|-----|-----|-----|------|
| $R_{th(j-a)}$  | thermal resistance from junction to ambient      | in free air | [1] | -   | 351 | 404 | K/W  |
|                |                                                  |             | [2] | -   | 271 | 311 | K/W  |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |             |     | -   | 65  | 75  | K/W  |

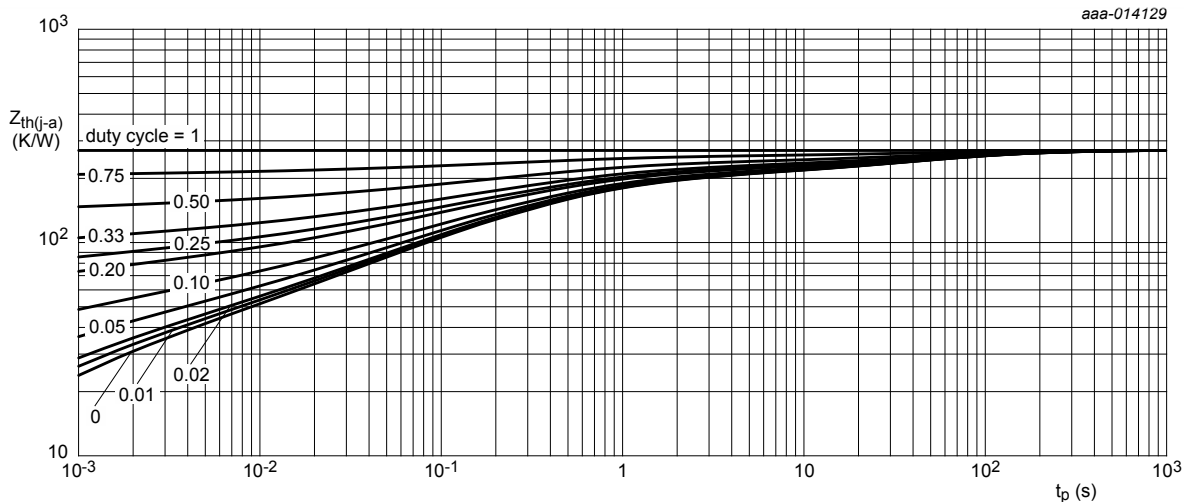
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain  $1 cm^2$ .



FR4 PCB, standard footprint

Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, mounting pad for drain 1 cm<sup>2</sup>

Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

| Symbol                  | Parameter                        | Conditions                                                                                                                  |  | Min | Typ  | Max  | Unit |
|-------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------|--|-----|------|------|------|
| Static characteristics  |                                  |                                                                                                                             |  |     |      |      |      |
| V <sub>(BR)DSS</sub>    | drain-source breakdown voltage   | I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                      |  | 55  | -    | -    | V    |
| V <sub>GSth</sub>       | gate-source threshold voltage    | I <sub>D</sub> = 250 μA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 25 °C                                         |  | 0.6 | 1    | 1.3  | V    |
| I <sub>DSS</sub>        | drain leakage current            | V <sub>DS</sub> = 55 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                       |  | -   | -    | 1    | μA   |
| I <sub>GSS</sub>        | gate leakage current             | V <sub>GS</sub> = 10 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                       |  | -   | -    | 5    | μA   |
|                         |                                  | V <sub>GS</sub> = -10 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                      |  | -   | -    | -5   | μA   |
|                         |                                  | V <sub>GS</sub> = 4.5 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                      |  | -   | -    | 0.3  | μA   |
|                         |                                  | V <sub>GS</sub> = -4.5 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                     |  | -   | -    | -0.3 | μA   |
| R <sub>DSon</sub>       | drain-source on-state resistance | V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 200 mA; T <sub>j</sub> = 25 °C                                                    |  | -   | 2.3  | 4    | Ω    |
|                         |                                  | V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 200 mA; T <sub>j</sub> = 150 °C                                                   |  | -   | 4.7  | 8.1  | Ω    |
|                         |                                  | V <sub>GS</sub> = 2.5 V; I <sub>D</sub> = 75 mA; T <sub>j</sub> = 25 °C                                                     |  | -   | 2.7  | 5    | Ω    |
|                         |                                  | V <sub>GS</sub> = 1.8 V; I <sub>D</sub> = 30 mA; T <sub>j</sub> = 25 °C                                                     |  | -   | 4.8  | -    | Ω    |
| g <sub>fs</sub>         | forward transconductance         | V <sub>DS</sub> = 10 V; I <sub>D</sub> = 200 mA; T <sub>j</sub> = 25 °C                                                     |  | -   | 0.64 | -    | S    |
| Dynamic characteristics |                                  |                                                                                                                             |  |     |      |      |      |
| Q <sub>G(tot)</sub>     | total gate charge                | V <sub>DS</sub> = 30 V; I <sub>D</sub> = 200 mA; V <sub>GS</sub> = 4.5 V; T <sub>j</sub> = 25 °C                            |  | -   | 0.5  | -    | nC   |
| Q <sub>GS</sub>         | gate-source charge               |                                                                                                                             |  | -   | 0.08 | -    | nC   |
| Q <sub>GD</sub>         | gate-drain charge                |                                                                                                                             |  | -   | 0.16 | -    | nC   |
| C <sub>iss</sub>        | input capacitance                | V <sub>DS</sub> = 30 V; f = 1 MHz; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                                            |  | -   | 19.1 | 30   | pF   |
| C <sub>oss</sub>        | output capacitance               |                                                                                                                             |  | -   | 2.7  | 10   | pF   |
| C <sub>rss</sub>        | reverse transfer capacitance     |                                                                                                                             |  | -   | 1.5  | 7    | pF   |
| t <sub>d(on)</sub>      | turn-on delay time               | V <sub>DS</sub> = 30 V; I <sub>D</sub> = 200 mA; V <sub>GS</sub> = 4.5 V; R <sub>G(ext)</sub> = 6 Ω; T <sub>j</sub> = 25 °C |  | -   | 8.3  | 12   | ns   |
| t <sub>r</sub>          | rise time                        |                                                                                                                             |  | -   | 8.4  | -    | ns   |
| t <sub>d(off)</sub>     | turn-off delay time              |                                                                                                                             |  | -   | 12.6 | 16   | ns   |
| t <sub>f</sub>          | fall time                        |                                                                                                                             |  | -   | 4.8  | -    | ns   |
| Source-drain diode      |                                  |                                                                                                                             |  |     |      |      |      |
| V <sub>SD</sub>         | source-drain voltage             | I <sub>S</sub> = 200 mA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                      |  | -   | 0.86 | 1.2  | V    |

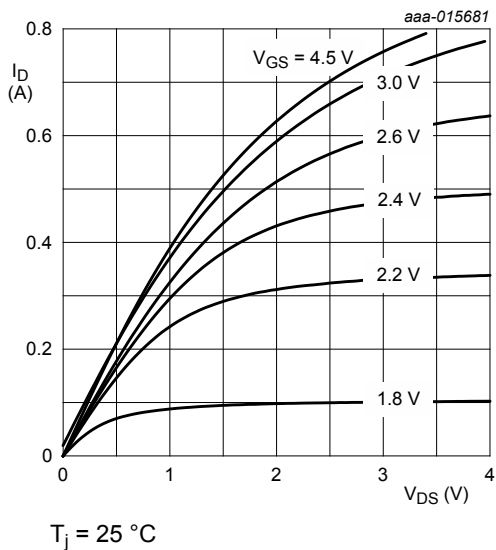


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

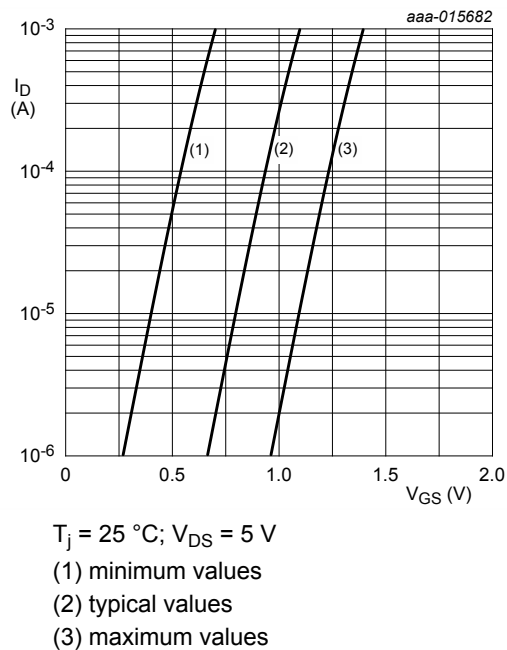


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

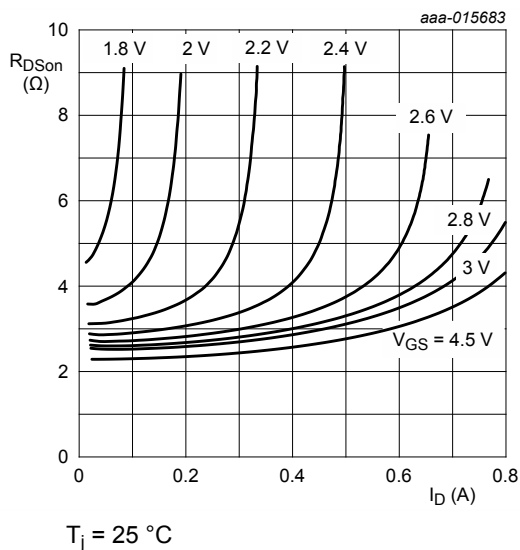


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

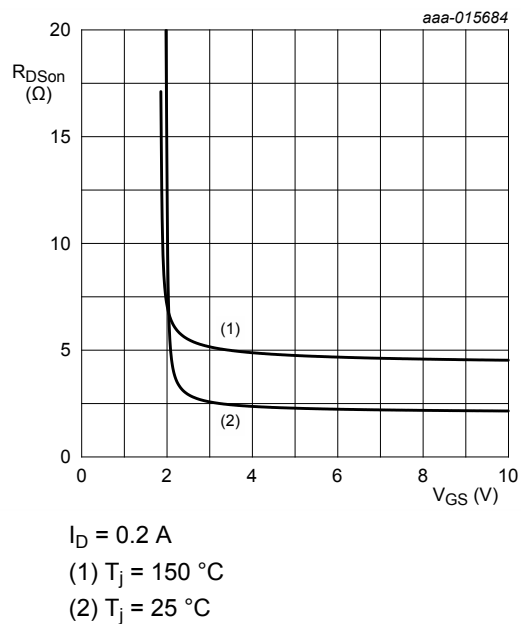
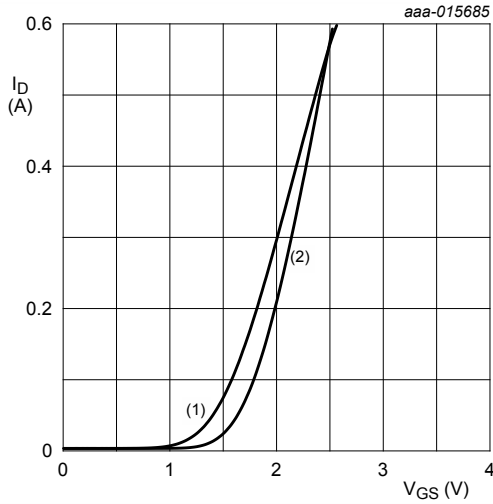


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

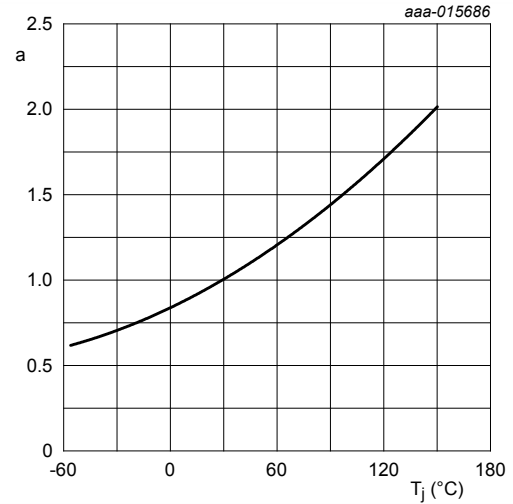


$V_{DS} > I_D \times R_{DS(on)}$

(1)  $T_j = 25\text{ °C}$

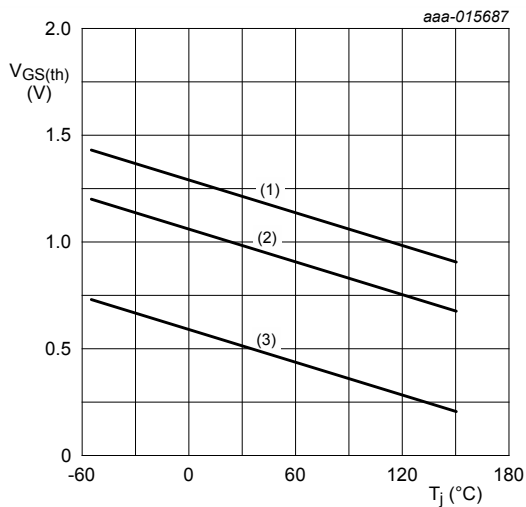
(2)  $T_j = 150\text{ °C}$

**Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values**



**Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values**

$$a = \frac{R_{DS(on)}}{R_{DS(on)25^\circ\text{C}}}$$



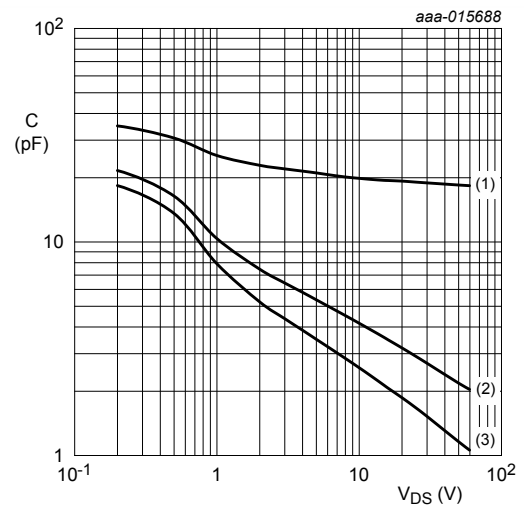
$I_D = 0.25\text{ mA}; V_{DS} = V_{GS}$

(1) maximum values

(2) typical values

(3) minimum values

**Fig. 12. Gate-source threshold voltage as a function of junction temperature**



$f = 1\text{ MHz}; V_{GS} = 0\text{ V}$

(1)  $C_{iss}$

(2)  $C_{oss}$

(3)  $C_{rss}$

**Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**



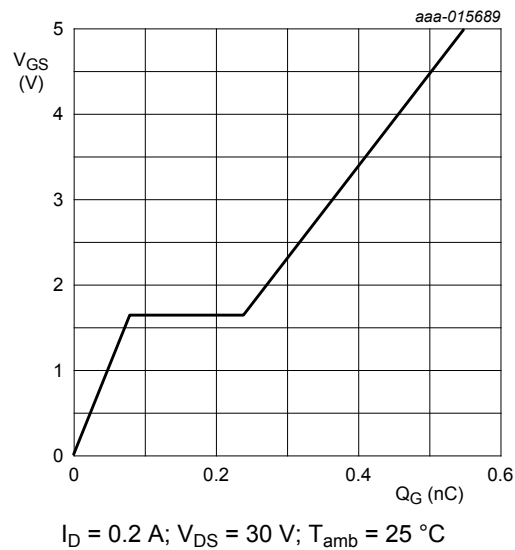


Fig. 14. Gate-source voltage as a function of gate charge; typical values

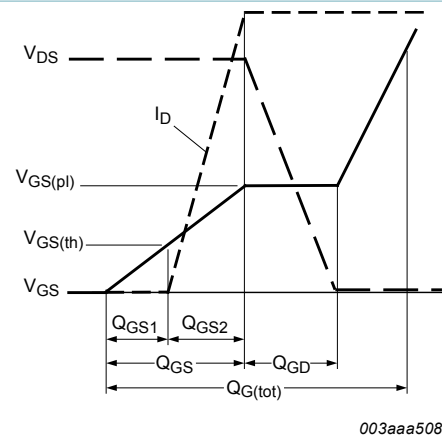
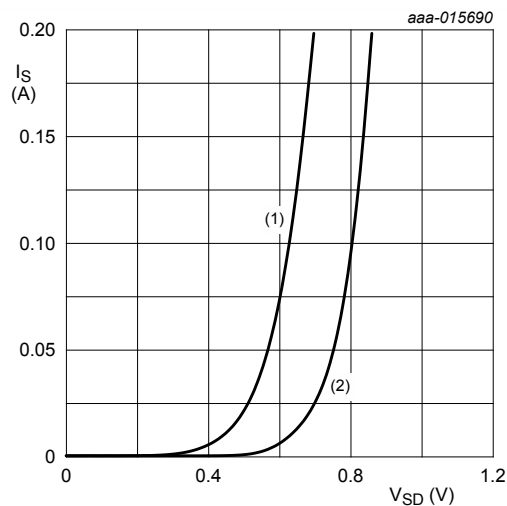


Fig. 15. MOSFET transistor: Gate charge waveform definitions



$V_{GS} = 0\text{ V}$   
(1)  $T_j = 150\text{ }^{\circ}\text{C}$   
(2)  $T_j = 25\text{ }^{\circ}\text{C}$

Fig. 16. Source current as a function of source-drain voltage; typical values

## 11. Test information

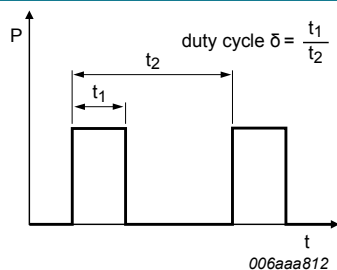


Fig. 17. Duty cycle definition

12. Package outline

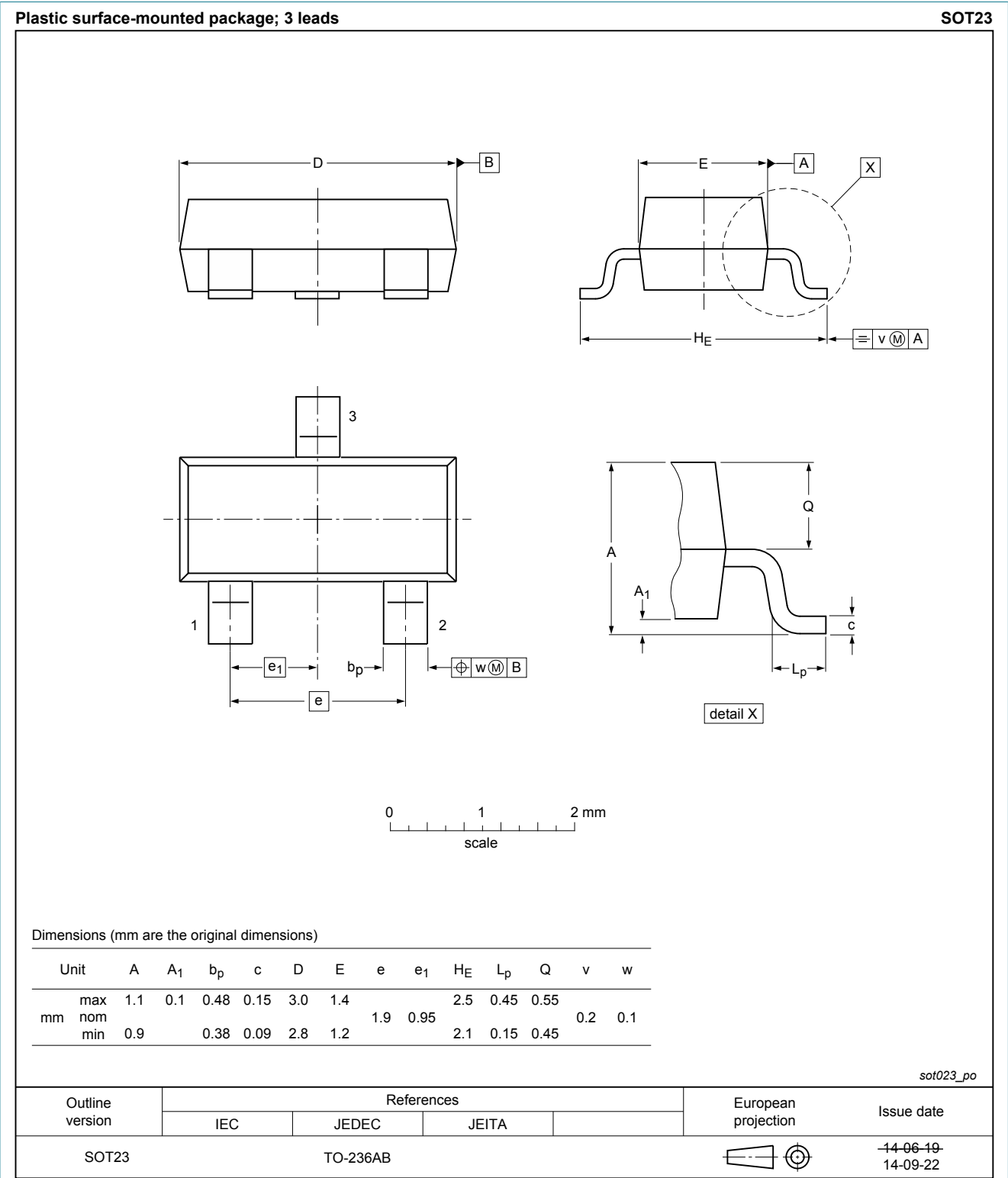


Fig. 18. Package outline TO-236AB (SOT23)

13. Soldering

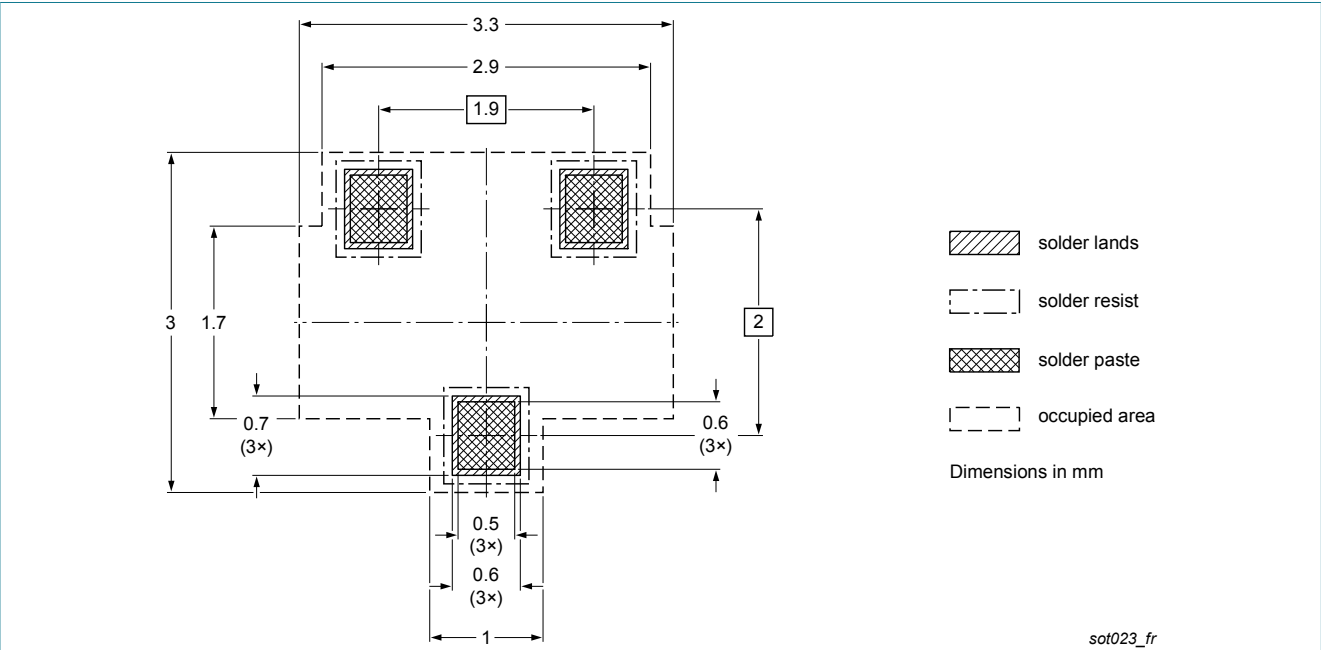


Fig. 19. Reflow soldering footprint for TO-236AB (SOT23)

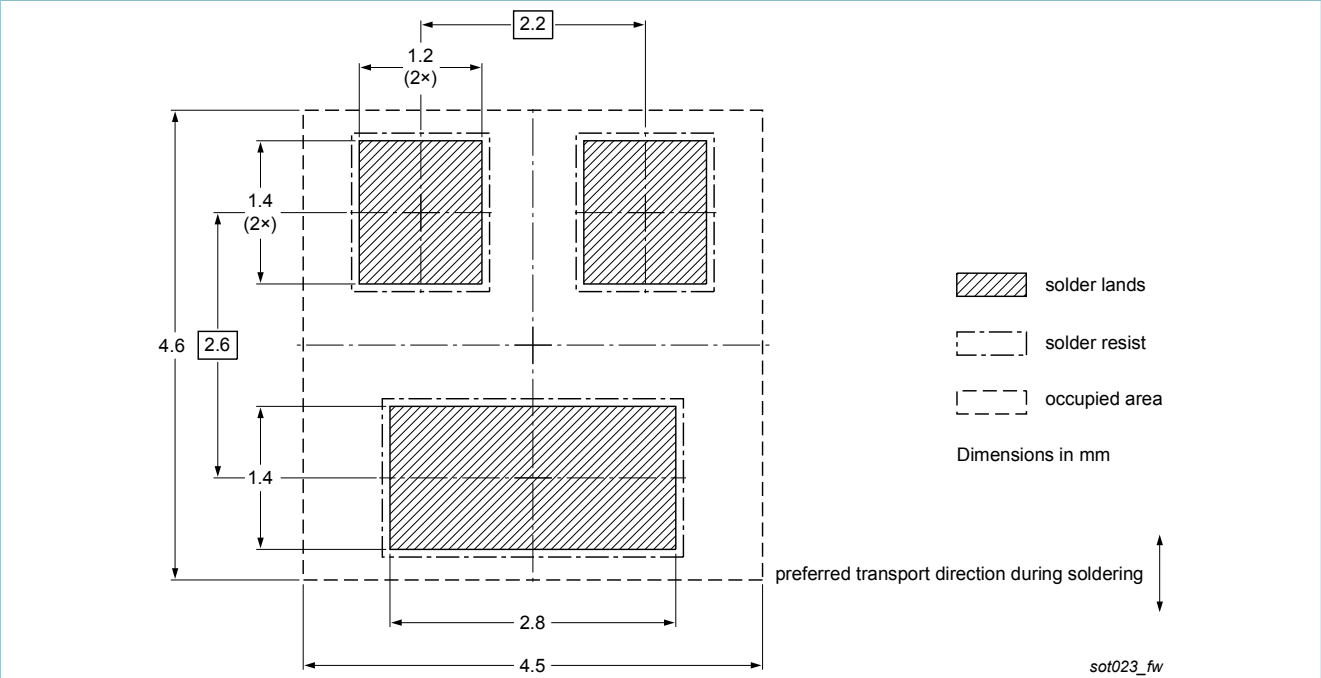


Fig. 20. Wave soldering footprint for TO-236AB (SOT23)

## 14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status  | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| BSH111BK v.1  | 20141126     | Product data sheet | -             | -          |

## 15. Legal information

### 15.1 Data sheet status

| Document status [1][2]         | Product status [3] | Definition                                                                            |
|--------------------------------|--------------------|---------------------------------------------------------------------------------------|
| Objective [short] data sheet   | Development        | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification      | This document contains data from the preliminary specification.                       |
| Product [short] data sheet     | Production         | This document contains the product specification.                                     |

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- [2] The term 'short data sheet' is explained in section "Definitions".
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16. Contents

1 General description ..... 1

2 Features and benefits ..... 1

3 Applications ..... 1

4 Quick reference data ..... 1

5 Pinning information ..... 2

6 Ordering information ..... 2

7 Marking ..... 2

8 Limiting values ..... 3

9 Thermal characteristics ..... 4

10 Characteristics ..... 6

11 Test information ..... 10

12 Package outline ..... 11

13 Soldering ..... 12

14 Revision history ..... 13

15 Legal information ..... 14

15.1 Data sheet status ..... 14

15.2 Definitions ..... 14

15.3 Disclaimers ..... 14

15.4 Trademarks ..... 15

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Date of release: 26 November 2014





**Стандарт  
Электрон  
Связь**

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

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