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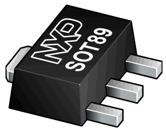



# BSS87

## 200 V, N-channel vertical D-MOS transistor

9 December 2014 — Product data sheet

## 1. General description

N-channel enhancement mode vertical Double-Diffused Field-Effect Transistor (D-MOSFET) in a SOT89 (SC-62) medium power and flat lead Surface-Mounted Device (SMD) plastic package.

## 2. Features and benefits

- Direct interface to Complementary (C-MOS) transistor and Transistor-Transistor Logic (TTL) devices.
- Very fast switching
- No secondary breakdown

## 3. Applications

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

## 4. Quick reference data

**Table 1. Quick reference data**

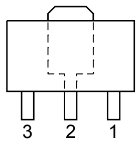
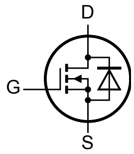
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | $T_j$ = 25 °C | | - | - | 200 | V |
| $V_{GS}$ | gate-source voltage | | | -20 | - | 20 | V |
| $I_D$ | drain current | $V_{GS}$ = 10 V; $T_{amb}$ = 25 °C | [1] | - | - | 0.4 | A |
| **Static characteristics** | | | | | | | |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 10 V; $I_D$ = 0.4 A; $T_j$ = 25 °C | | - | 1.6 | 3 | Ω |

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

Scan or click this QR code to view the latest information for this product

# 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | S | source |  SOT89 |  017aaa253 |
| 2 | D | drain | | |
| 3 | G | gate | | |

# 6. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| BSS87 | SOT89 | plastic surface-mounted package; die pad for good heat transfer; 3 leads | SOT89 |

# 7. Marking

**Table 4. Marking codes**

| Type number | Marking code |
|---|---|
| BSS87 | KA |

# 8. Limiting values

**Table 5. Limiting values**

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

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | $T_j$ = 25 °C | | - | 200 | V |
| $V_{GS}$ | gate-source voltage | | | -20 | 20 | V |
| $I_D$ | drain current | $V_{GS}$ = 10 V; $T_{amb}$ = 25 °C; t ≤ 5 s | [1] | - | 0.7 | A |
| | | $V_{GS}$ = 10 V; $T_{amb}$ = 25 °C | [1] | - | 0.4 | A |
| | | $V_{GS}$ = 10 V; $T_{amb}$ = 100 °C | [1] | - | 0.2 | A |
| $I_{DM}$ | peak drain current | $T_{amb}$ = 25 °C; single pulse; $t_p$ ≤ 10 µs | | - | 1.6 | A |
| $P_{tot}$ | total power dissipation | $T_{amb}$ = 25 °C | [2] | - | 0.58 | W |
| | | | [1] | - | 1 | W |
| | | $T_{sp}$ = 25 °C | | - | 12.5 | W |
| $T_j$ | junction temperature | | | -55 | 150 | °C |
| $T_{amb}$ | ambient temperature | | | -55 | 150 | °C |
| $T_{stg}$ | storage temperature | | | -65 | 150 | °C |
| **Source-drain diode** | | | | | | |
| $I_S$ | source current | $T_{amb}$ = 25 °C | [1] | - | 0.4 | A |

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

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

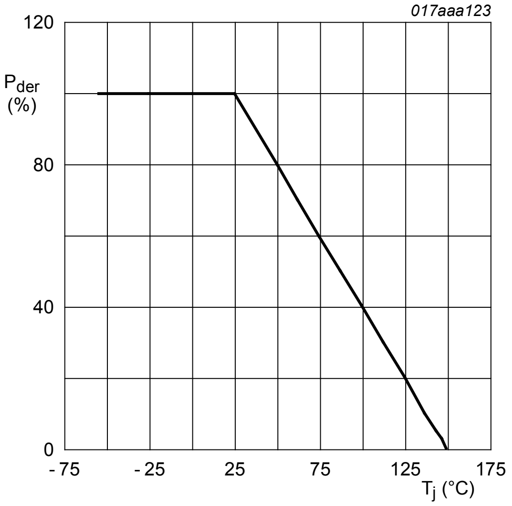



**Fig. 1. MOSFET transistor: Normalized total power dissipation as a function of junction temperature**

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

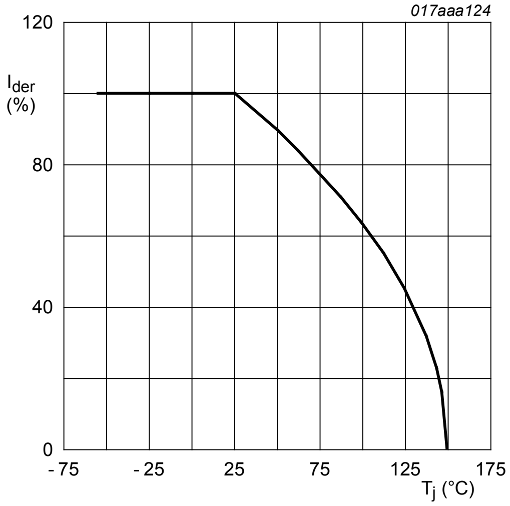
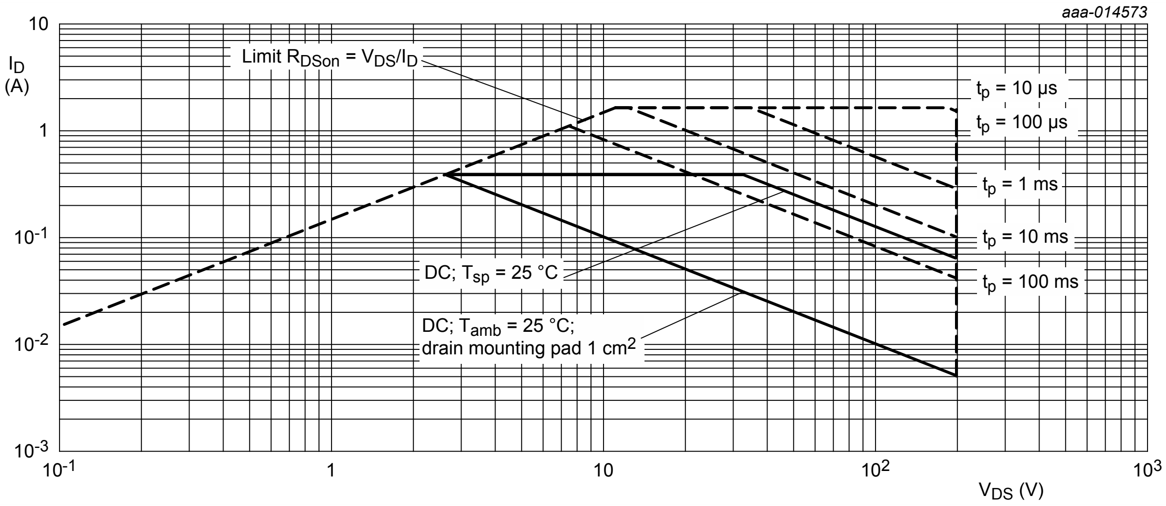



**Fig. 2. MOSFET transistor: Normalized continuous drain current as a function of junction temperature**

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




$I_{DM}$ = single pulse

**Fig. 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage**

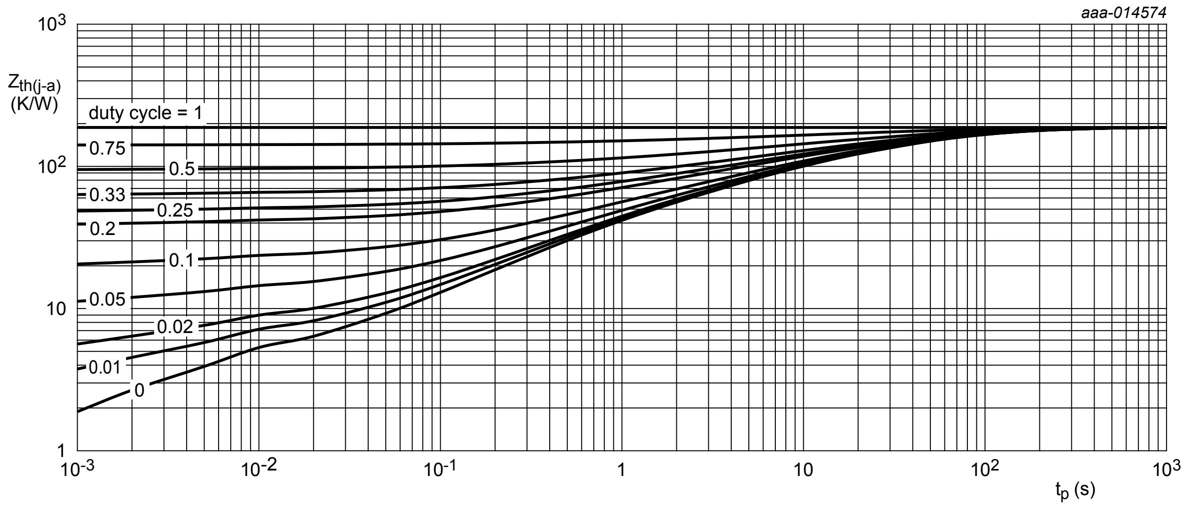
# 9. Thermal characteristics

**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] | - | 190 | 216 | K/W |
| | | | [2] | - | 105 | 125 | K/W |
| | | in free air; t ≤ 5 s | [2] | - | 36 | 42 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | | - | 6 | 10 | K/W |

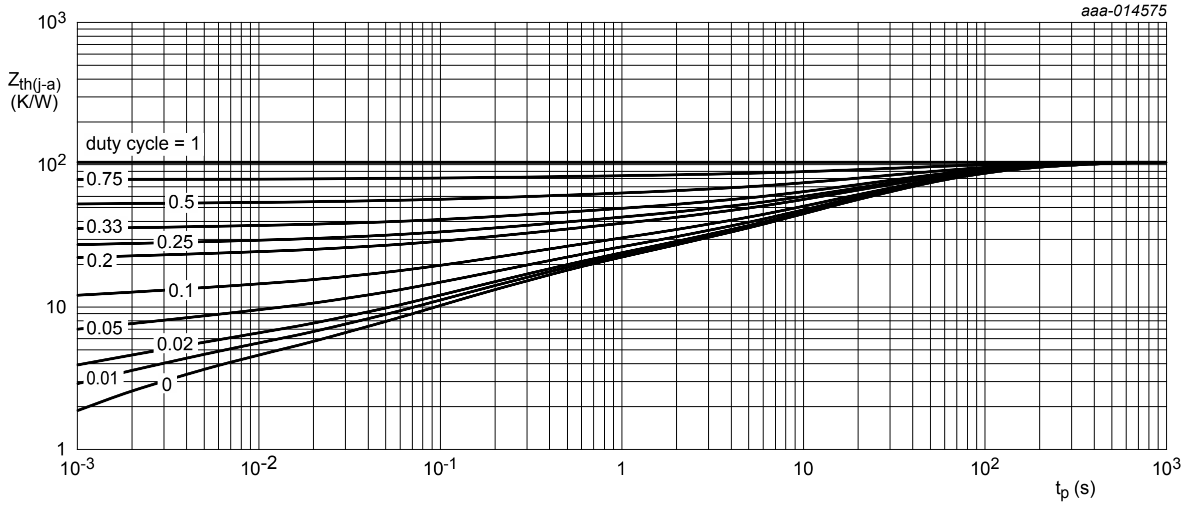
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 1 cm².




FR4 PCB, standard footprint

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



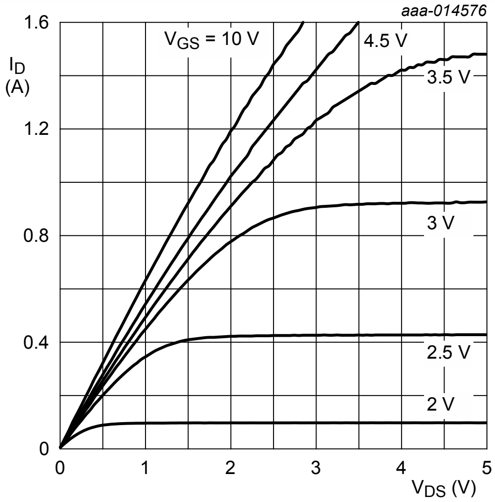

FR4 PCB, mounting pad for drain 1 $cm^2$

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

## 10. Characteristics

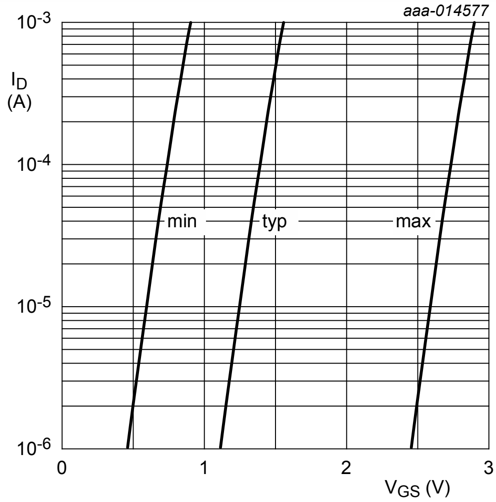
Table 7. Characteristics

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D$ = 250 μA; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | 200 | - | - | V |
| $V_{GSth}$ | gate-source threshold voltage | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 25 °C | | 0.8 | - | 2.8 | V |
| $I_{DSS}$ | drain leakage current | $V_{DS}$ = 60 V; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | - | - | 200 | nA |
| | | $V_{DS}$ = 200 V; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | - | - | 60 | μA |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = 20 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | | - | - | 100 | nA |
| | | $V_{GS}$ = -20 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | | - | - | -100 | nA |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 10 V; $I_D$ = 0.4 A; $T_j$ = 25 °C | | - | 1.6 | 3 | Ω |
| | | $V_{GS}$ = 10 V; $I_D$ = 0.4 A; $T_j$ = 150 °C | | - | 3.7 | 7 | Ω |
| | | $V_{GS}$ = 4.5 V; $I_D$ = 0.3 A; $T_j$ = 25 °C | | - | 1.9 | 4 | Ω |
| $g_{fs}$ | forward transconductance | $V_{DS}$ = 25 V; $I_D$ = 0.4 A; $T_j$ = 25 °C | | - | 0.8 | - | S |
| **Dynamic characteristics** | | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $V_{DS}$ = 50 V; $I_D$ = 0.25 A; $V_{GS}$ = 10 V; $T_j$ = 25 °C | | - | 5.5 | 10 | nC |
| $Q_{GS}$ | gate-source charge | | | - | 0.3 | - | nC |
| $Q_{GD}$ | gate-drain charge | | | - | 1.4 | - | nC |
| $C_{iss}$ | input capacitance | $V_{DS}$ = 25 V; f = 1 MHz; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | - | 100 | 120 | pF |
| $C_{oss}$ | output capacitance | | | - | 20 | 30 | pF |
| $C_{rss}$ | reverse transfer capacitance | | | - | 10 | 15 | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS}$ = 50 V; $I_D$ = 0.25 A; $V_{GS}$ = 10 V; $R_{G(ext)}$ = 6 Ω; $T_j$ = 25 °C | | - | 2.7 | 6 | ns |
| $t_r$ | rise time | | | - | 3.7 | 6 | ns |
| $t_{d(off)}$ | turn-off delay time | | | - | 16.4 | 30 | ns |
| $t_f$ | fall time | | | - | 7.5 | 20 | ns |
| **Source-drain diode** | | | | | | | |
| $V_{SD}$ | source-drain voltage | $I_S$ = 0.4 A; $V_{GS}$ = 0 V; $T_j$ = 25 °C | | - | 0.8 | 1.2 | V |



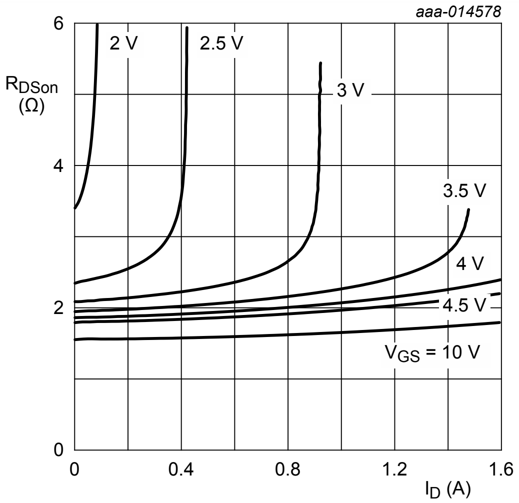

$T_j$ = 25 °C

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



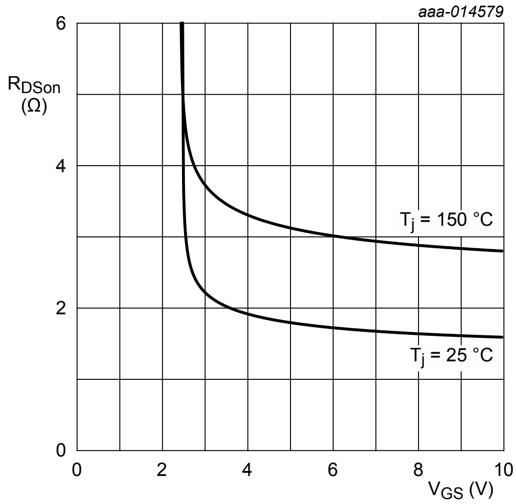

$T_j$ = 25 °C; $V_{DS}$ = 10 V

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



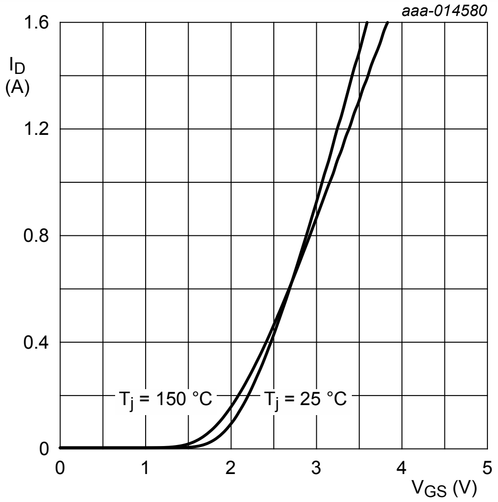

$T_j$ = 25 °C

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




$I_D$ = 0.4 A

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




$V_{DS} > I_D \times R_{DSon}$

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

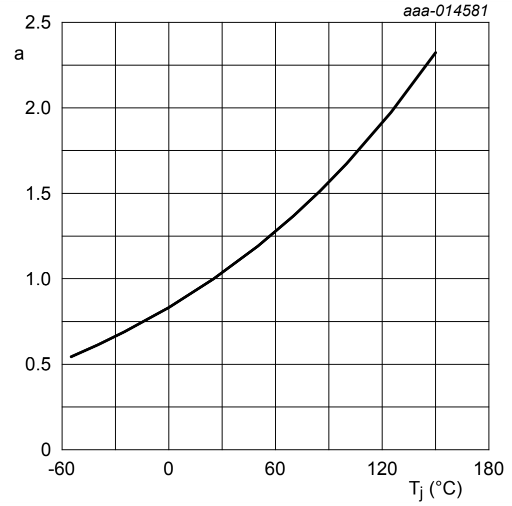
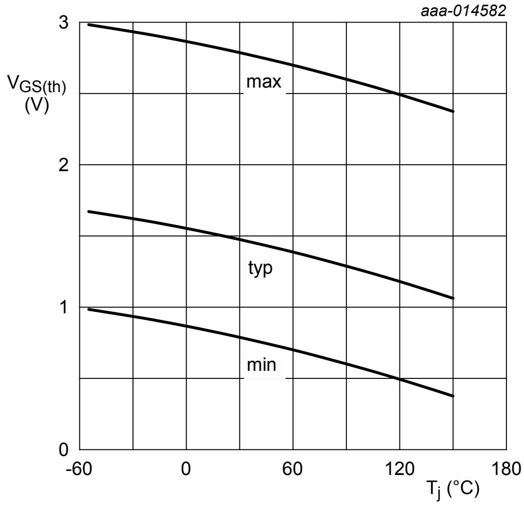


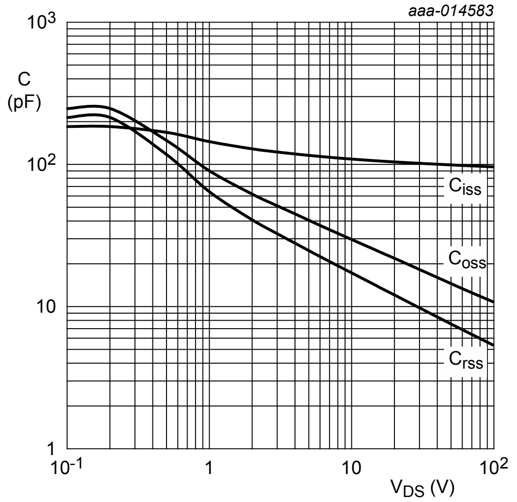

**Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values**

$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$



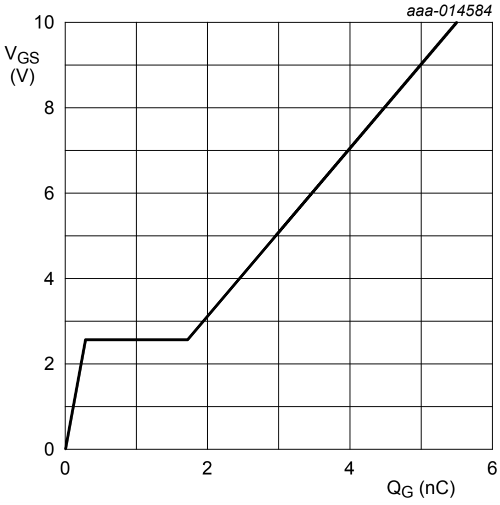

$I_D$ = 1 mA; $V_{DS} = V_{GS}$

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




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

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




$I_D$ = 0.25 A; $V_{DS}$ = 50 V; $T_{amb}$ = 25 °C

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

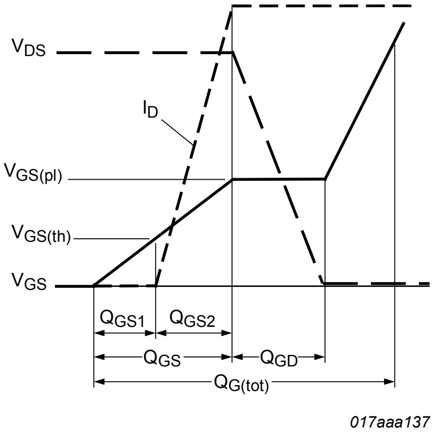
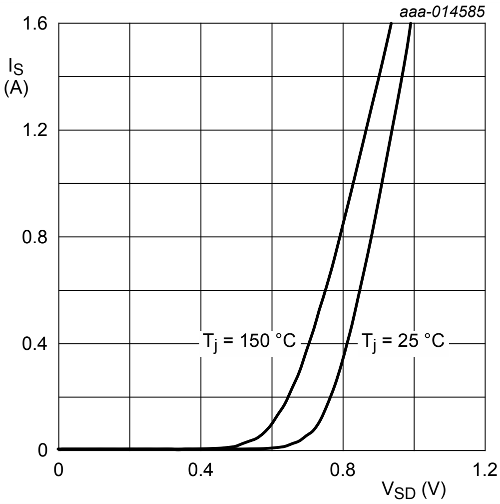



**Fig. 15. MOSFET transistor: Gate charge waveform definitions**




$V_{GS}$ = 0 V

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

## 11. Test information

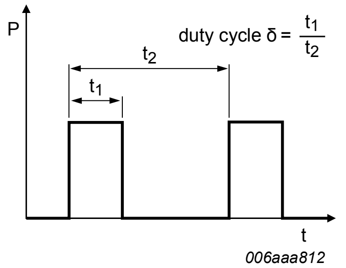
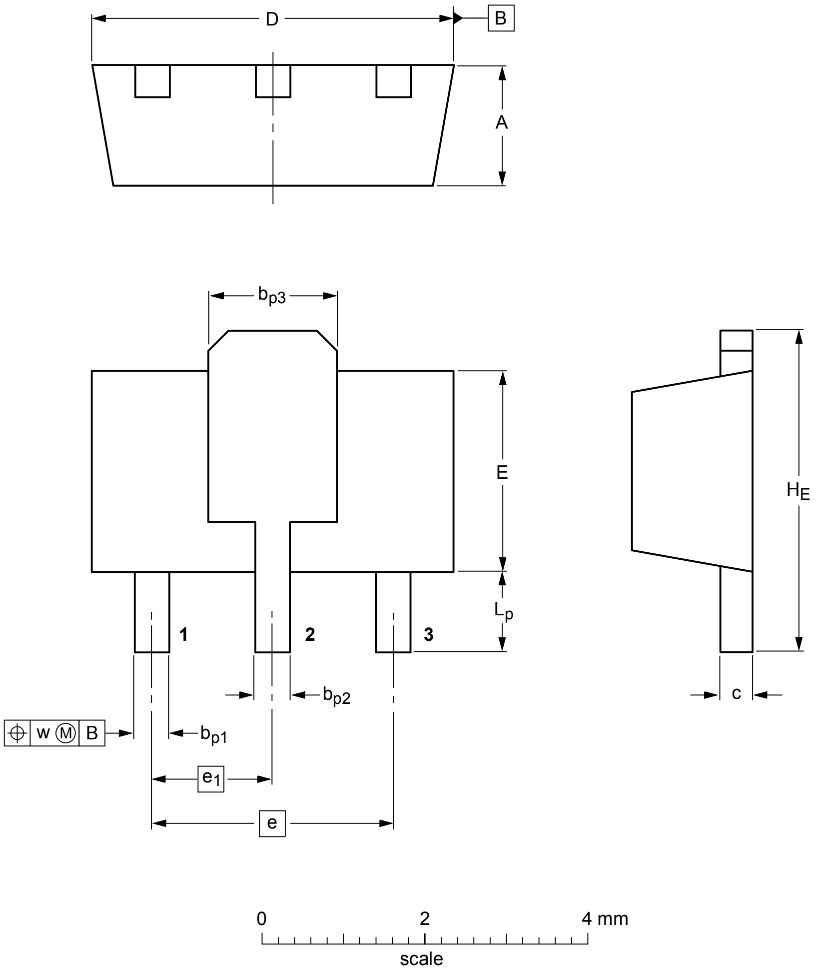



**Fig. 17. Duty cycle definition**

## 12. Package outline

**Plastic surface-mounted package; exposed die pad for good heat transfer; 3 leads** **SOT89**




**DIMENSIONS** (mm are the original dimensions)

| UNIT | A | $b_{p1}$ | $b_{p2}$ | $b_{p3}$ | c | D | E | e | $e_1$ | $H_E$ | $L_p$ | w |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.6<br>1.4 | 0.48<br>0.35 | 0.53<br>0.40 | 1.8<br>1.4 | 0.44<br>0.23 | 4.6<br>4.4 | 2.6<br>2.4 | 3.0 | 1.5 | 4.25<br>3.75 | 1.2<br>0.8 | 0.13 |

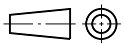
| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT89 | | TO-243 | SC-62 | |  | ~~06-03-16~~<br>06-08-29 |

Fig. 18. Package outline SOT89

# 13. Soldering

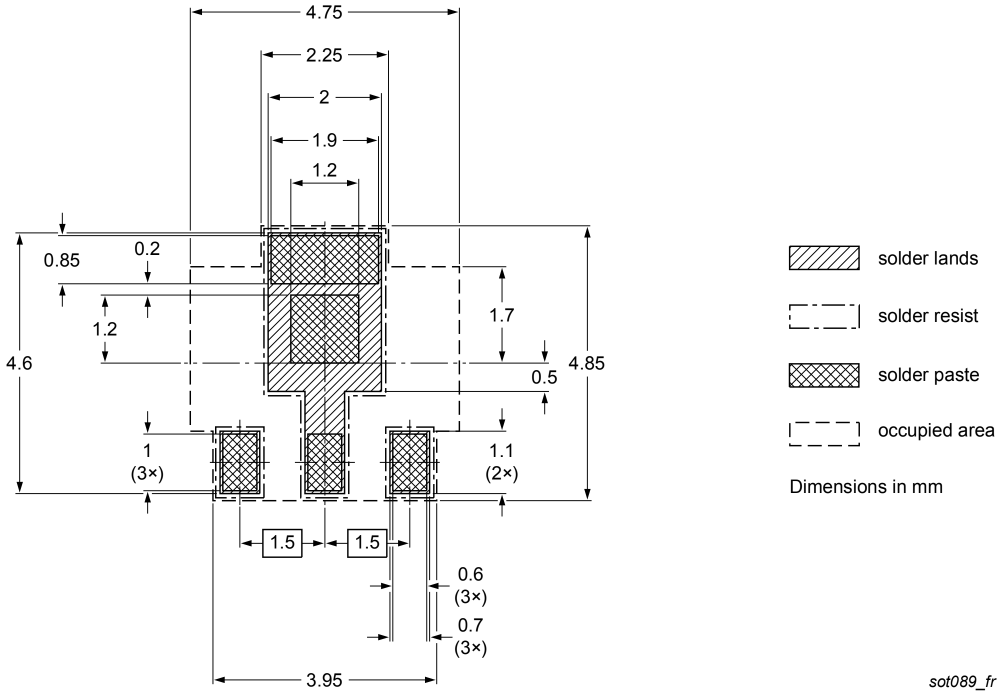



**Fig. 19. Reflow soldering footprint for SOT89**

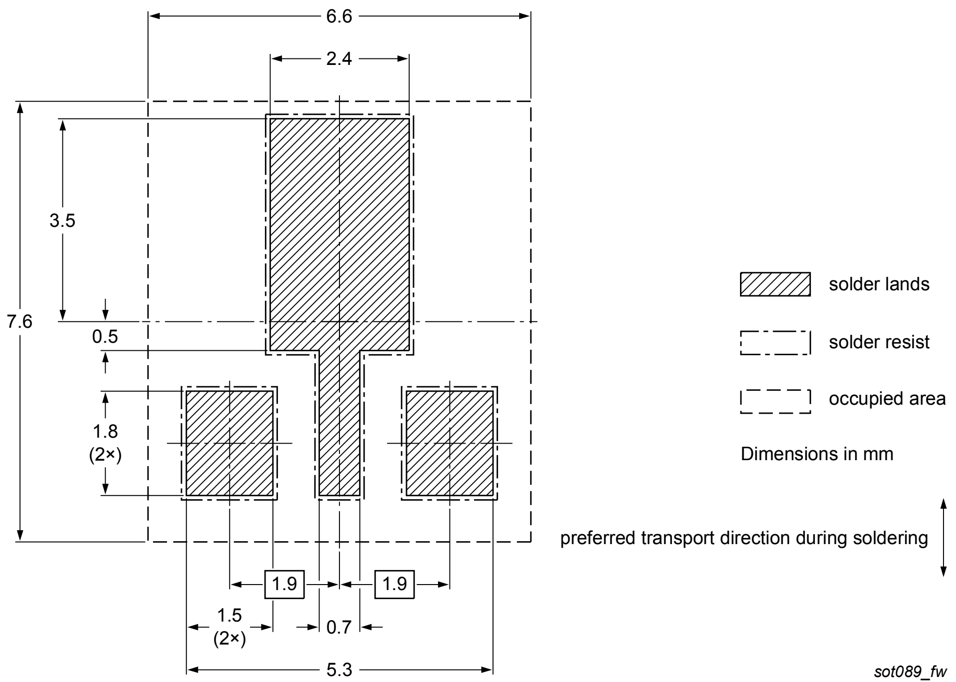



**Fig. 20. Wave soldering footprint for SOT89**

## 14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BSS87 v.5 | 20141209 | Product data sheet | - | BSS87 v.4 |
| Modifications: | • Figure 3 corrected. | | | |
| BSS87 v.4 | 20140815 | Product data sheet | - | BSS87 v.3 |
| BSS87 v.3 | 20010518 | Product specification | - | BSS87 v.2 |
| BSS87 v.2 | 19970623 | Product specification | - | BSS87 v.1 |

# 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. |

[1] Please consult the most recently issued document before initiating or completing a design.

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

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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