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Kind regards,

Team Nexperia



# 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	$T_j = 25^\circ\text{C}$		-	-	200	V
$V_{GS}$	gate-source voltage			-20	-	20	V
$I_D$	drain current	$V_{GS} = 10\text{ V}; T_{amb} = 25^\circ\text{C}$	[1]	-	-	0.4	A
<b>Static characteristics</b>							
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 0.4\text{ A}; T_j = 25^\circ\text{C}$		-	1.6	3	$\Omega$

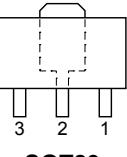
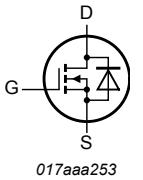
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 1 cm<sup>2</sup>.



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## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source		
2	D	drain		
3	G	gate	 <b>SOT89</b>	

## 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

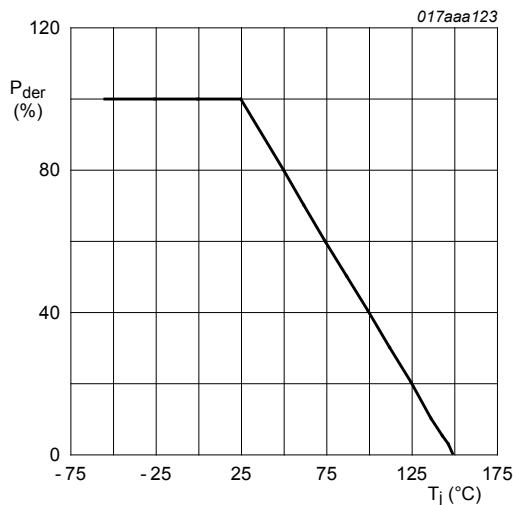
**Table 5. Limiting values**

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

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

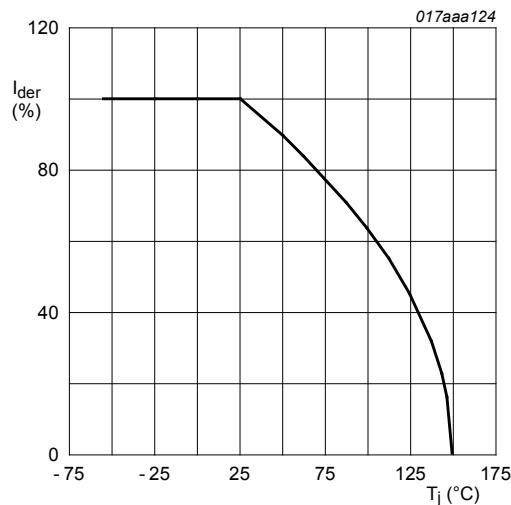
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain  $1\text{ cm}^2$ .

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



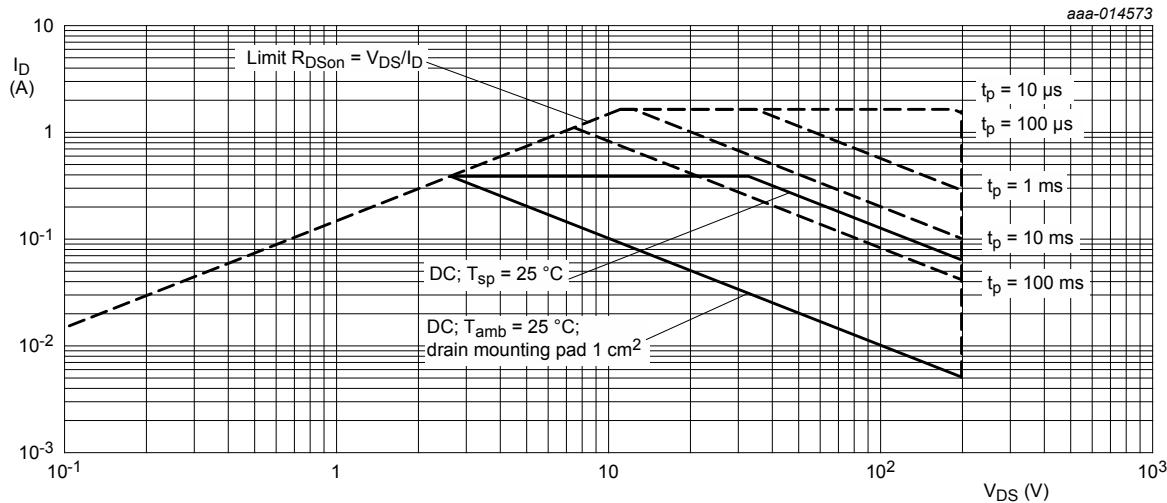
**Fig. 1. MOSFET transistor: Normalized total power dissipation as a function of junction temperature**

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



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

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



$I_{DM}$  = single pulse

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

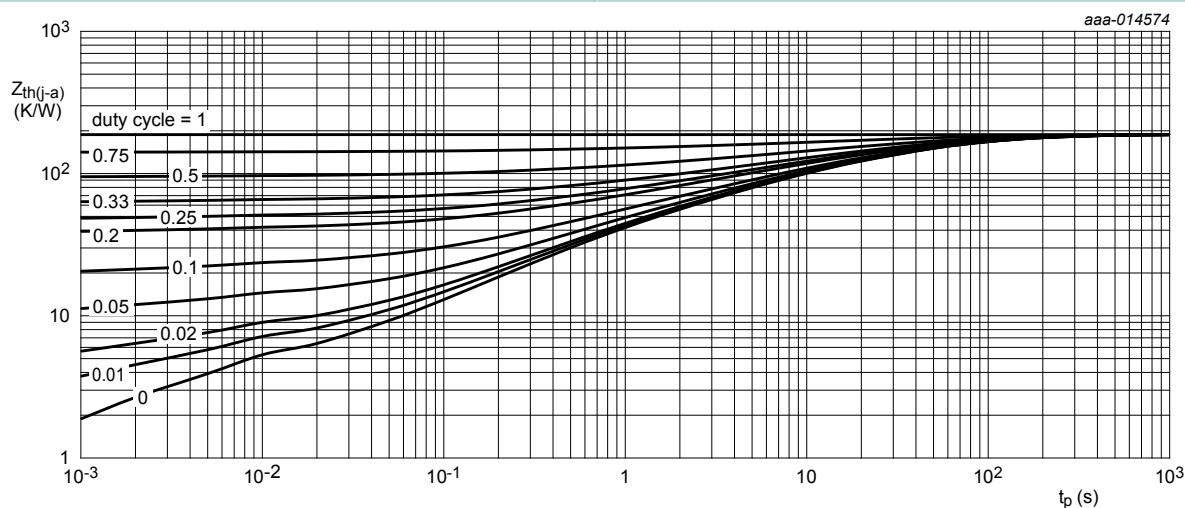
## 9. Thermal characteristics

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; $t \leq 5$ s	[2]	-	36	42	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	6	10	K/W

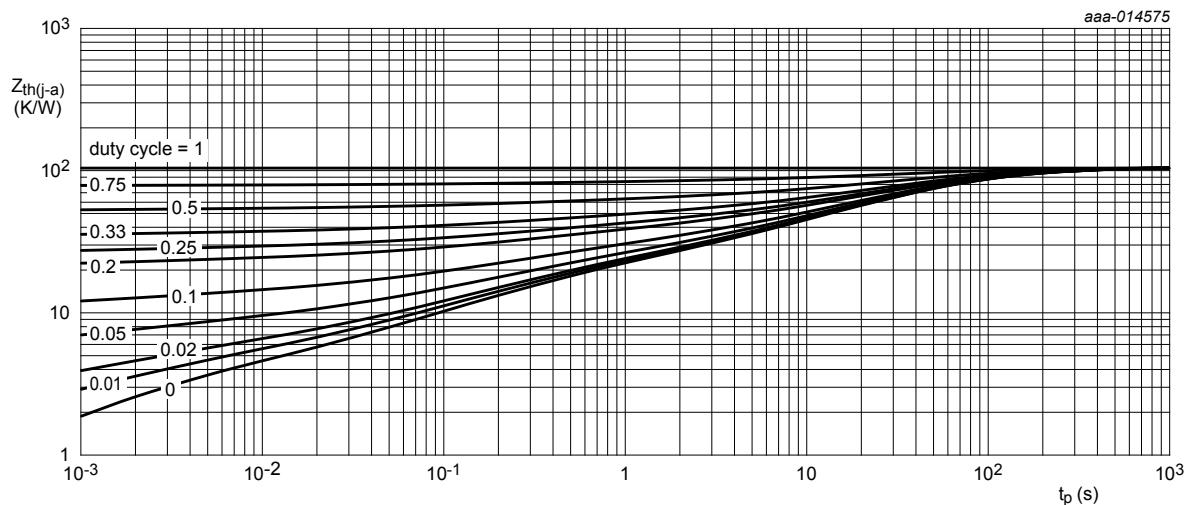
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

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



FR4 PCB, standard footprint

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



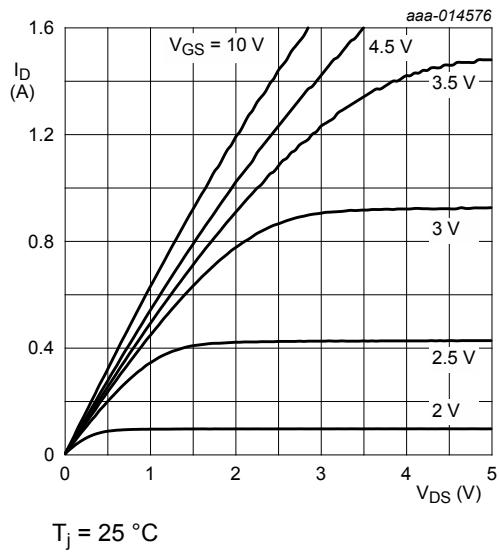
FR4 PCB, mounting pad for drain 1 cm<sup>2</sup>

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

## 10. Characteristics

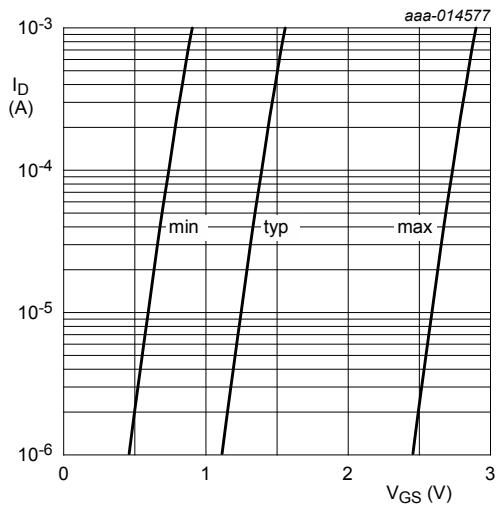
Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Static characteristics</b>							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A$ ; $V_{GS} = 0 V$ ; $T_j = 25^\circ C$		200	-	-	V
$V_{GSth}$	gate-source threshold voltage	$I_D = 1 mA$ ; $V_{DS} = V_{GS}$ ; $T_j = 25^\circ C$		0.8	-	2.8	V
$I_{DSS}$	drain leakage current	$V_{DS} = 60 V$ ; $V_{GS} = 0 V$ ; $T_j = 25^\circ C$		-	-	200	nA
		$V_{DS} = 200 V$ ; $V_{GS} = 0 V$ ; $T_j = 25^\circ C$		-	-	60	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 20 V$ ; $V_{DS} = 0 V$ ; $T_j = 25^\circ C$		-	-	100	nA
		$V_{GS} = -20 V$ ; $V_{DS} = 0 V$ ; $T_j = 25^\circ C$		-	-	-100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10 V$ ; $I_D = 0.4 A$ ; $T_j = 25^\circ C$		-	1.6	3	$\Omega$
		$V_{GS} = 10 V$ ; $I_D = 0.4 A$ ; $T_j = 150^\circ C$		-	3.7	7	$\Omega$
		$V_{GS} = 4.5 V$ ; $I_D = 0.3 A$ ; $T_j = 25^\circ C$		-	1.9	4	$\Omega$
$g_{fs}$	forward transconductance	$V_{DS} = 25 V$ ; $I_D = 0.4 A$ ; $T_j = 25^\circ C$		-	0.8	-	S
<b>Dynamic characteristics</b>							
$Q_{G(tot)}$	total gate charge	$V_{DS} = 50 V$ ; $I_D = 0.25 A$ ; $V_{GS} = 10 V$ ; $T_j = 25^\circ C$		-	5.5	10	nC
$Q_{GS}$	gate-source charge			-	0.3	-	nC
$Q_{GD}$	gate-drain charge			-	1.4	-	nC
$C_{iss}$	input capacitance	$V_{DS} = 25 V$ ; $f = 1 MHz$ ; $V_{GS} = 0 V$ ; $T_j = 25^\circ C$		-	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	$V_{DS} = 50 V$ ; $I_D = 0.25 A$ ; $V_{GS} = 10 V$ ; $R_{G(ext)} = 6 \Omega$ ; $T_j = 25^\circ C$		-	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
<b>Source-drain diode</b>							
$V_{SD}$	source-drain voltage	$I_S = 0.4 A$ ; $V_{GS} = 0 V$ ; $T_j = 25^\circ C$		-	0.8	1.2	V



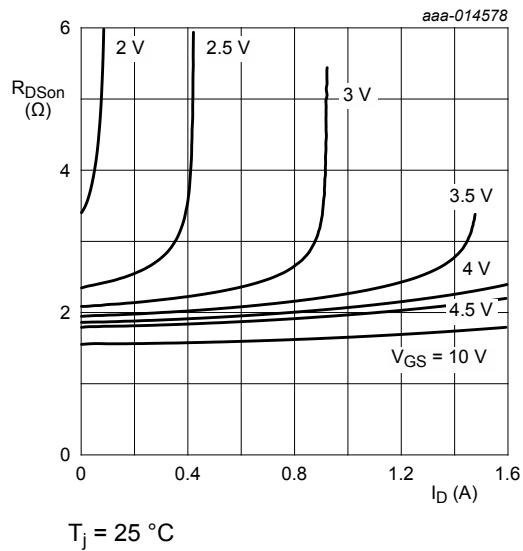
$T_j = 25^\circ\text{C}$

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



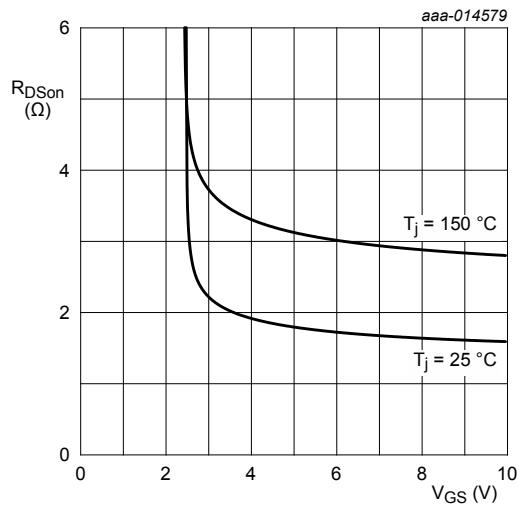
$T_j = 25^\circ\text{C}; V_{DS} = 10\text{ V}$

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



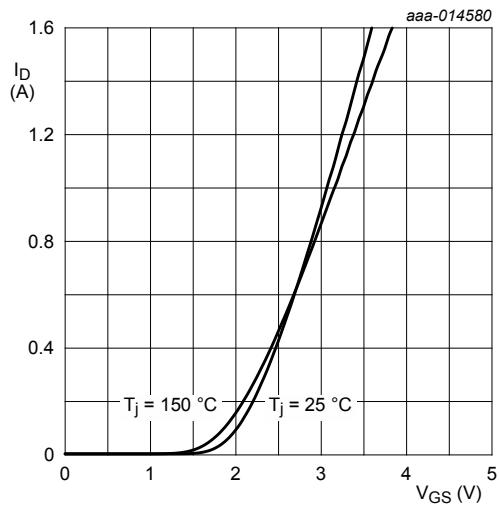
$T_j = 25^\circ\text{C}$

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



$I_D = 0.4\text{ A}$

**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

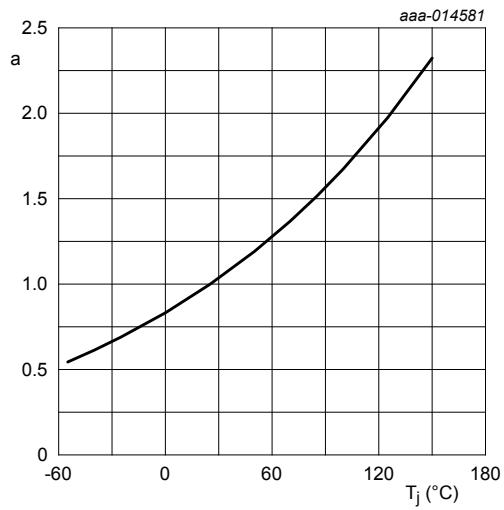
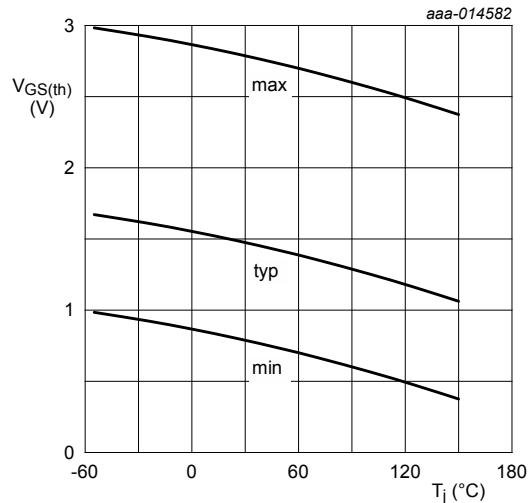


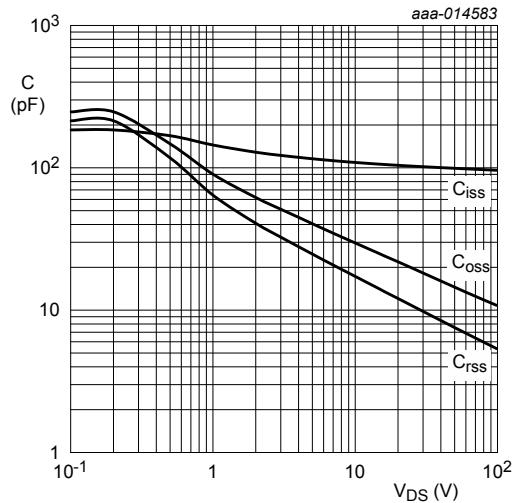
Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

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



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

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



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

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

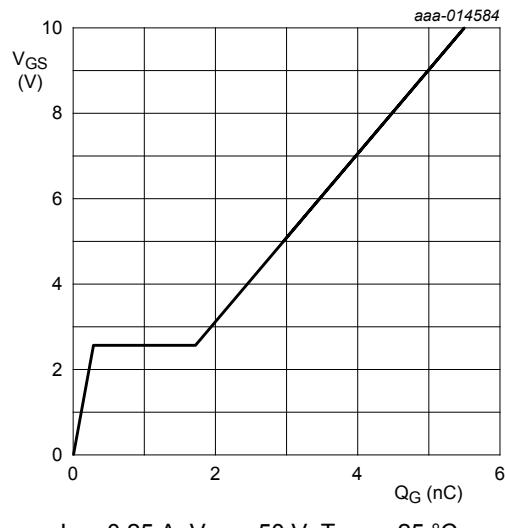


Fig. 14. Gate-source voltage as a function of gate charge; typical values

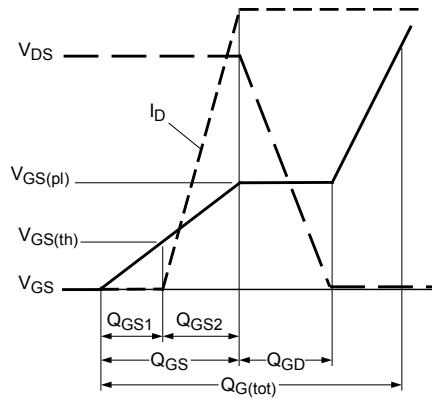
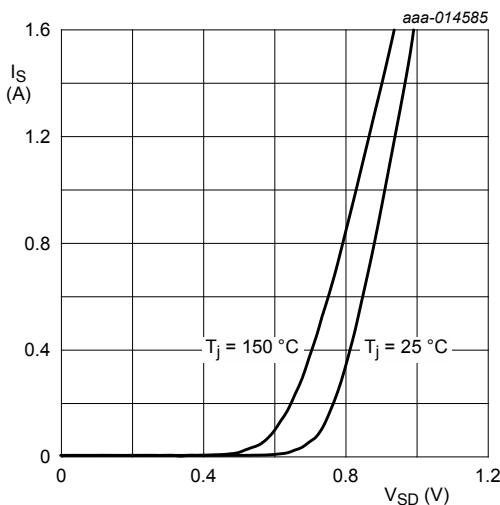


Fig. 15. MOSFET transistor: Gate charge waveform definitions



$V_{GS} = 0 \text{ V}$

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

## 11. Test information

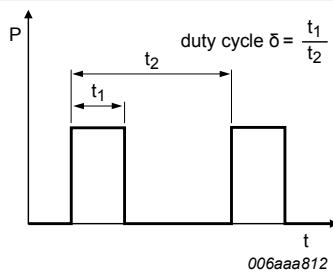
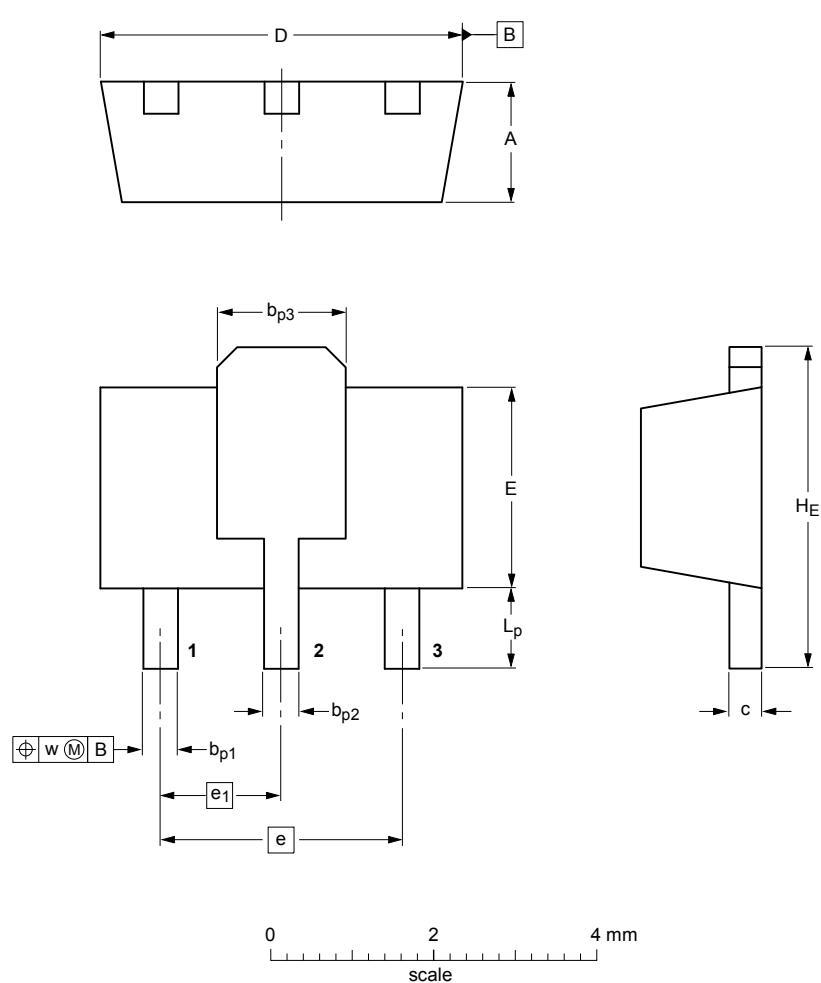


Fig. 17. Duty cycle definition

## 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 1.4	0.48 0.35	0.53 0.40	1.8 1.4	0.44 0.23	4.6 4.4	2.6 2.4	3.0	1.5	4.25 3.75	1.2 0.8	0.13

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

Fig. 18. Package outline SOT89

## 13. Soldering

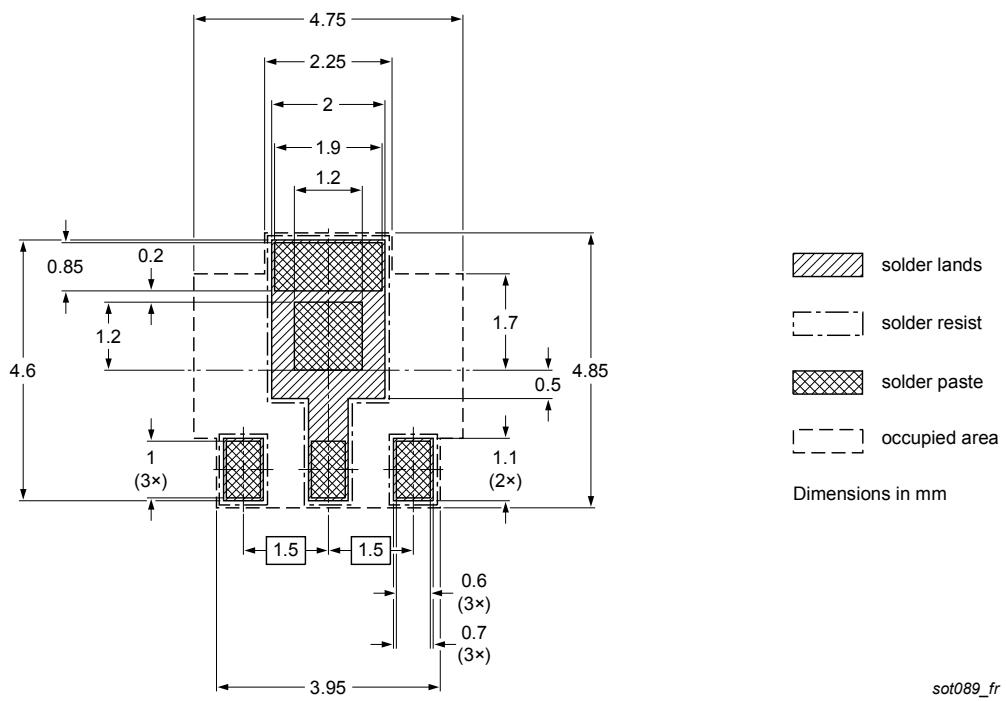


Fig. 19. Reflow soldering footprint for SOT89

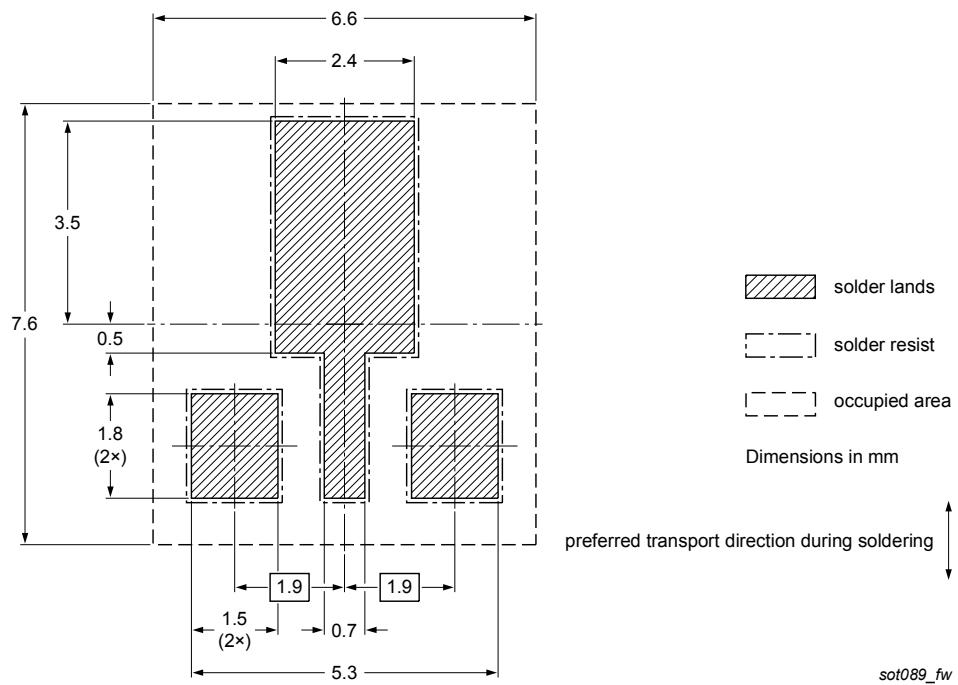


Fig. 20. Wave soldering footprint for SOT89

## 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:	<ul style="list-style-type: none"><li>Figure 3 corrected.</li></ul>			
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.

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Date of release: 9 December 2014

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