

PSMN8R5-100XS

N-channel 100V 8.5 mΩ standard level MOSFET in TO220F (SOT186A)

29 November 2012

Product data sheet

1. Product profile

1.1 General description

Standard level N-channel MOSFET in TO220F (SOT186A) package qualified to 175C. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

1.2 Features and benefits

- High efficiency due to low switching and conduction losses
- Isolated package
- Suitable for standard level gate drive

1.3 Applications

- AC-to-DC power supply equipment
- Motor control
- Server power supplies
- Synchronous rectification

1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25 \text{ }^\circ\text{C}$; $T_j \leq 175 \text{ }^\circ\text{C}$		-	-	100	V
I_D	drain current	$T_{mb} = 25 \text{ }^\circ\text{C}$; $V_{GS} = 10 \text{ V}$; Fig. 1		-	-	49	A
P_{tot}	total power dissipation	$T_{mb} = 25 \text{ }^\circ\text{C}$; Fig. 2		-	-	55	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10 \text{ V}$; $I_D = 10 \text{ A}$; $T_j = 25 \text{ }^\circ\text{C}$; Fig. 12 ; Fig. 13		4.5	6.4	8.5	mΩ
		$V_{GS} = 10 \text{ V}$; $I_D = 10 \text{ A}$; $T_j = 100 \text{ }^\circ\text{C}$; Fig. 13		-	11.18	14.9	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	$V_{GS} = 10 \text{ V}$; $I_D = 10 \text{ A}$; $V_{DS} = 50 \text{ V}$; Fig. 14 ; Fig. 15		-	30	-	nC
$Q_{G(tot)}$	total gate charge			-	100	-	nC



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Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10$ V; $T_{j(init)} = 25$ °C; $I_D = 49$ A; $V_{sup} \leq 100$ V; unclamped; $R_{GS} = 50$ Ω; Fig. 3		-	-	439	mJ

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate		
2	D	drain		
3	S	source		
mb		mounting base; isolated	 TO-220F (SOT186A)	 mbb076

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN8R5-100XS	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"	SOT186A

4. Marking

Table 4. Marking codes

Type number	Marking code
PSMN8R5-100XS	PSMN8R5-100XS

5. 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	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	100	V

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DGR}	drain-gate voltage	$T_j \geq 25^\circ\text{C}$; $T_j \leq 175^\circ\text{C}$; $R_{GS} = 20\text{ k}\Omega$	-	100	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 25^\circ\text{C}$; Fig. 1	-	49	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 100^\circ\text{C}$; Fig. 1	-	34.6	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25^\circ\text{C}$; Fig. 4	-	196	A
P_{tot}	total power dissipation	$T_{mb} = 25^\circ\text{C}$; Fig. 2	-	55	W
T_{stg}	storage temperature		-55	175	°C
T_j	junction temperature		-55	175	°C
$T_{sld(M)}$	peak soldering temperature		-	260	°C
Source-drain diode					
I_S	source current	$T_{mb} = 25^\circ\text{C}$	-	46	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25^\circ\text{C}$	-	196	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25^\circ\text{C}$; $I_D = 49\text{ A}$; $V_{sup} \leq 100\text{ V}$; unclamped; $R_{GS} = 50\text{ }\Omega$; Fig. 3	-	439	mJ

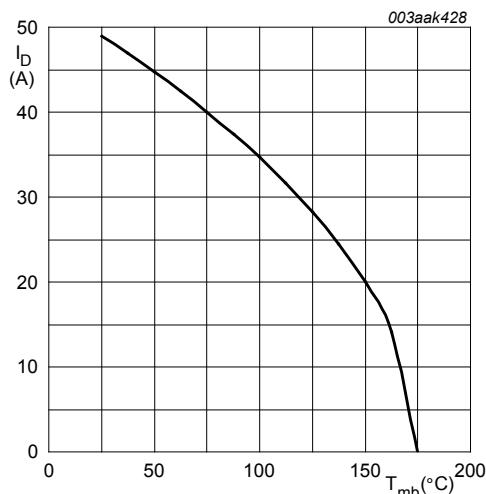


Fig. 1. Continuous drain current as a function of mounting base temperature

$$V_{GS} \geq 10\text{ V}$$

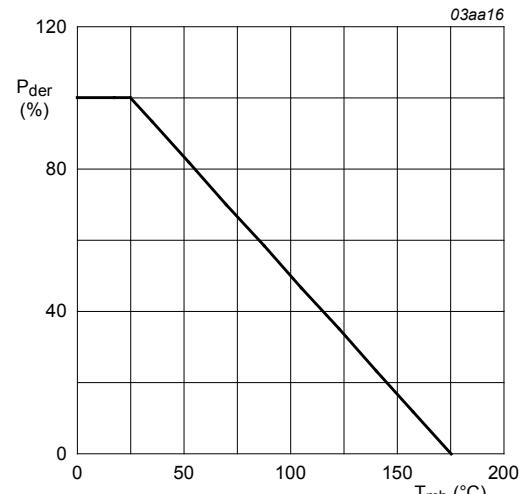


Fig. 2. Normalized total power dissipation as a function of mounting base temperature

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

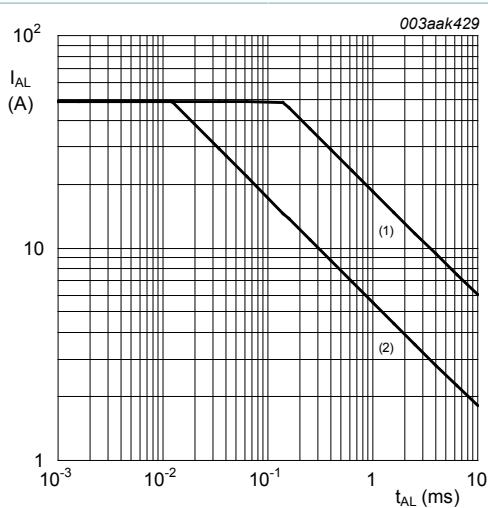


Fig. 3. Avalanche rating; avalanche current as a function of avalanche time

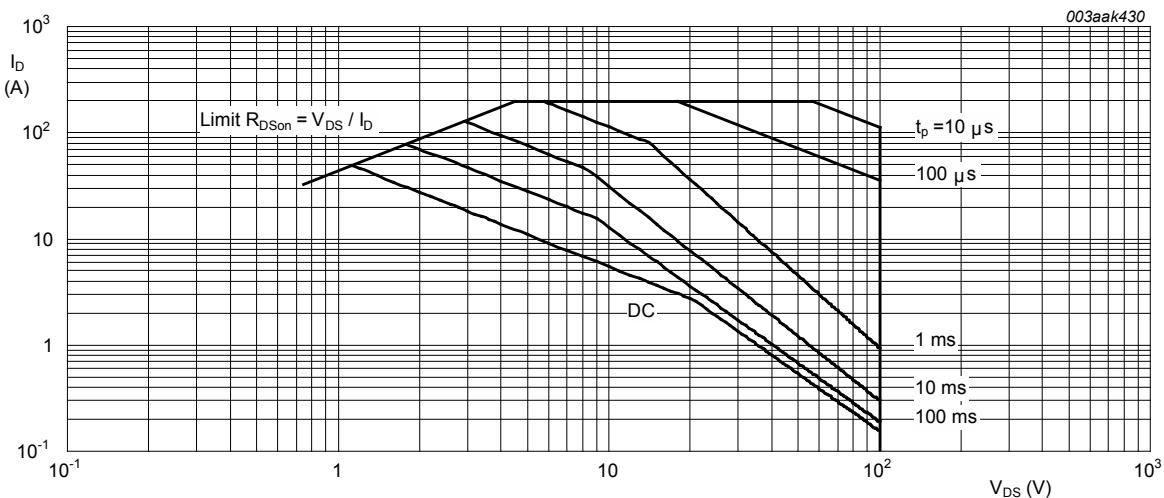
(1) $T_j \text{ (init)} = 25^\circ\text{C}$; (2) $T_j \text{ (init)} = 130^\circ\text{C}$ 

Fig. 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

 $T_{mb} = 25^\circ\text{C}$; I_{DM} is a single pulse

6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Fig. 5		-	2.5	2.73	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in free air		-	55	-	K/W

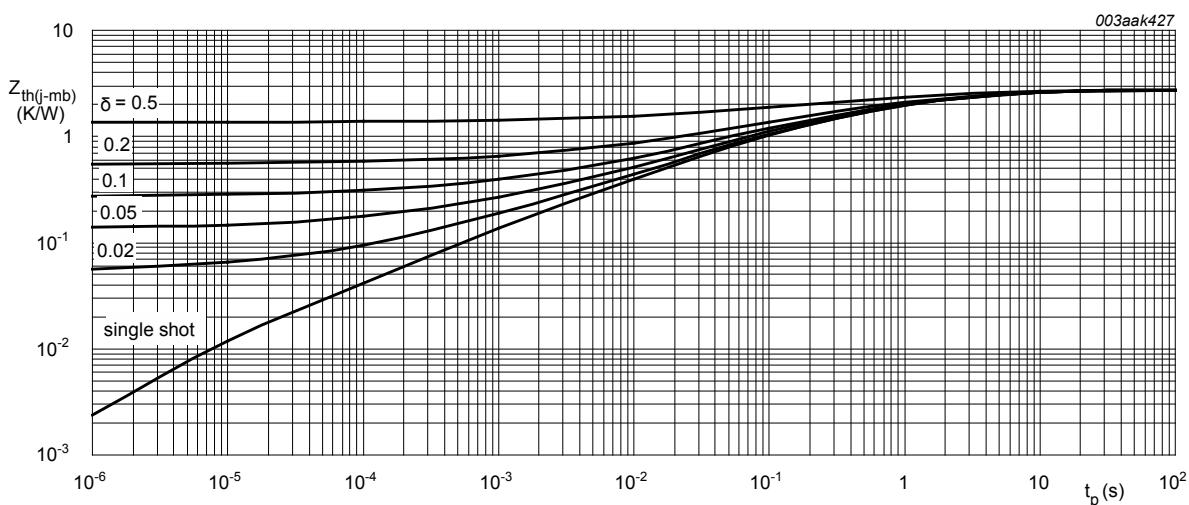


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

7. Isolation characteristics

Table 7. Isolation characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
C_{isol}	isolation capacitance		[1]	-	10	-	pF
$V_{\text{isol(RMS)}}$	RMS isolation voltage	50 Hz $\leq f \leq$ 60 Hz; RH \leq 65 %; sinusoidal waveform; clean and dust free		-	-	2500	V

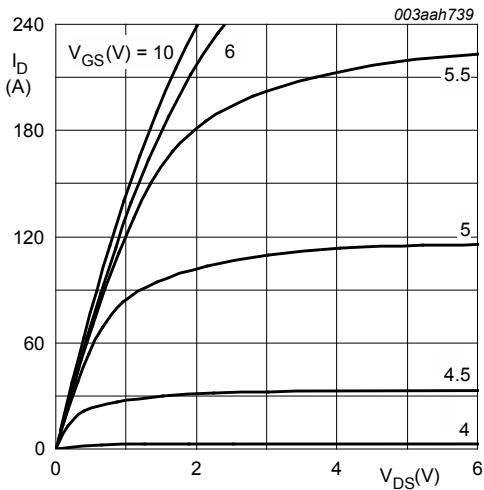
[1] $f = 1$ MHz

8. Characteristics

Table 8. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(\text{BR})\text{DSS}}$	drain-source breakdown voltage	$I_D = 250 \mu\text{A}$; $V_{GS} = 0$ V; $T_j = 25$ °C		100	-	-	V
		$I_D = 250 \mu\text{A}$; $V_{GS} = 0$ V; $T_j = -55$ °C		90	-	-	V
$V_{GS(\text{th})}$	gate-source threshold voltage	$I_D = 1$ mA; $V_{DS} = V_{GS}$; $T_j = 25$ °C; Fig. 10 ; Fig. 11		2.4	3	4	V
		$I_D = 1$ mA; $V_{DS} = V_{GS}$; $T_j = 175$ °C; Fig. 10		1	-	-	V
		$I_D = 1$ mA; $V_{DS} = V_{GS}$; $T_j = -55$ °C; Fig. 10		-	-	4.5	V
I_{DSS}	drain leakage current	$V_{DS} = 100$ V; $V_{GS} = 0$ V; $T_j = 25$ °C		-	0.02	1	μA
		$V_{DS} = 100$ V; $V_{GS} = 0$ V; $T_j = 100$ °C		-	-	20	μA

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I _{GSS}	gate leakage current	V _{GS} = 20 V; V _{DS} = 0 V; T _j = 25 °C		-	2	100	nA
		V _{GS} = -20 V; V _{DS} = 0 V; T _j = 25 °C		-	2	100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 10 A; T _j = 25 °C; Fig. 12 ; Fig. 13	4.5	6.4	8.5		mΩ
		V _{GS} = 10 V; I _D = 10 A; T _j = 100 °C; Fig. 13		-	11.18	14.9	mΩ
		V _{GS} = 10 V; I _D = 10 A; T _j = 175 °C; Fig. 13		-	16.95	22.6	mΩ
R _G	internal gate resistance (AC)	f = 1 MHz		0.36	0.71	1.42	Ω
Dynamic characteristics							
Q _{G(tot)}	total gate charge	I _D = 10 A; V _{DS} = 50 V; V _{GS} = 10 V; Fig. 14 ; Fig. 15		-	100	-	nC
Q _{GS}	gate-source charge			-	19	-	nC
Q _{GS(th)}	pre-threshold gate-source charge			-	14	-	nC
Q _{GS(th-pl)}	post-threshold gate-source charge			-	5	-	nC
Q _{GD}	gate-drain charge			-	30	-	nC
V _{GS(pl)}	gate-source plateau voltage	I _D = 10 A; V _{DS} = 50 V; Fig. 14 ; Fig. 15		-	4	-	V
C _{iss}	input capacitance	V _{DS} = 50 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C; Fig. 16 ; Fig. 17		-	5512	-	pF
C _{oss}	output capacitance	V _{DS} = 50 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C; Fig. 16		-	380	-	pF
C _{rss}	reverse transfer capacitance	V _{DS} = 50 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C; Fig. 16 ; Fig. 17		-	256	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = 50 V; R _L = 5 Ω; V _{GS} = 10 V; R _{G(ext)} = 5 Ω; T _j = 25 °C		-	21.5	-	ns
t _r	rise time			-	30	-	ns
t _{d(off)}	turn-off delay time			-	83	-	ns
t _f	fall time			-	40	-	ns
Source-drain diode							
V _{SD}	source-drain voltage	I _S = 10 A; V _{GS} = 0 V; T _j = 25 °C; Fig. 18		-	0.77	1.2	V
t _{rr}	reverse recovery time	I _S = 10 A; dI _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 50 V		-	53	-	ns
Q _r	recovered charge			-	124	-	nC



$T_j = 25^\circ\text{C}$; $t_p = 300 \mu\text{s}$

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

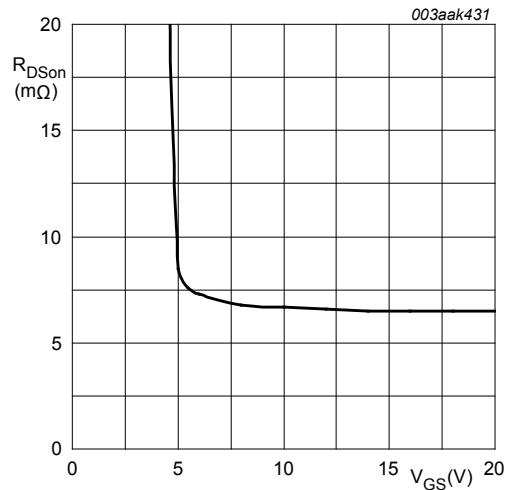


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25^\circ\text{C}$; $I_D = 10\text{A}$

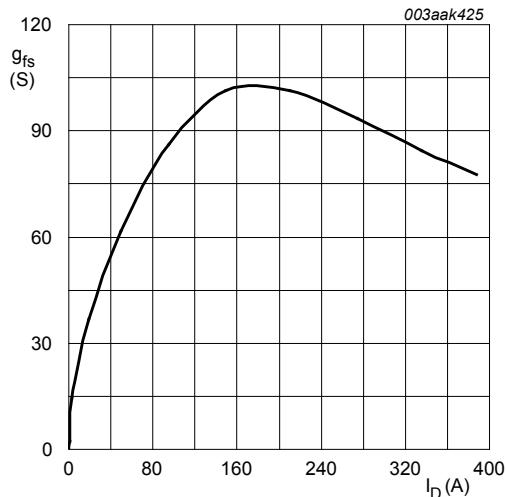


Fig. 8. Forward transconductance as a function of drain current; typical values

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

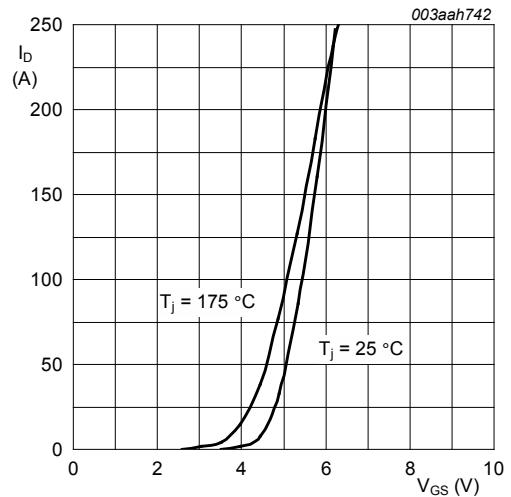


Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

$V_{DS} = 10\text{V}$

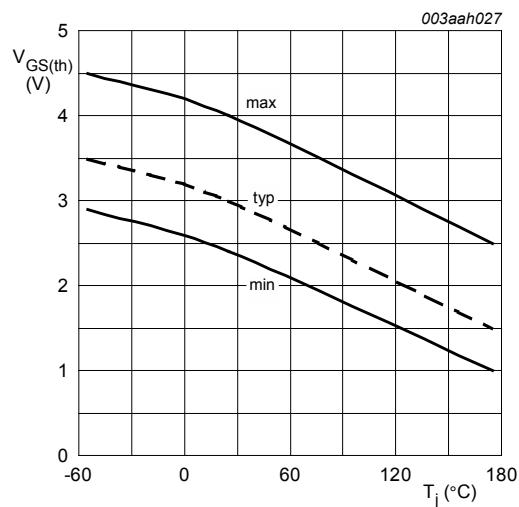


Fig. 10. Gate-source threshold voltage as a function of junction temperature

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

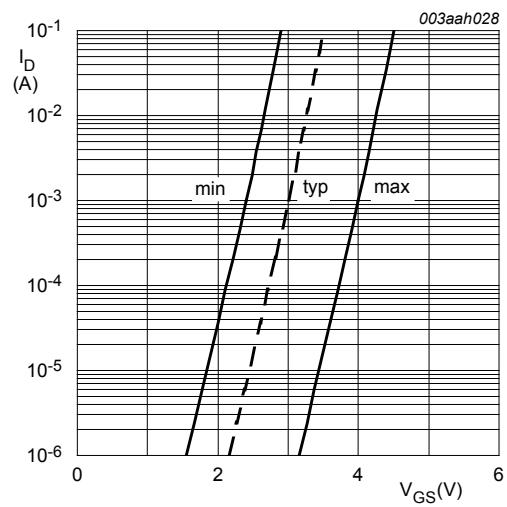


Fig. 11. Sub-threshold drain current as a function of gate-source voltage

$T_j = 25$ °C; $V_{DS} = 5$ V

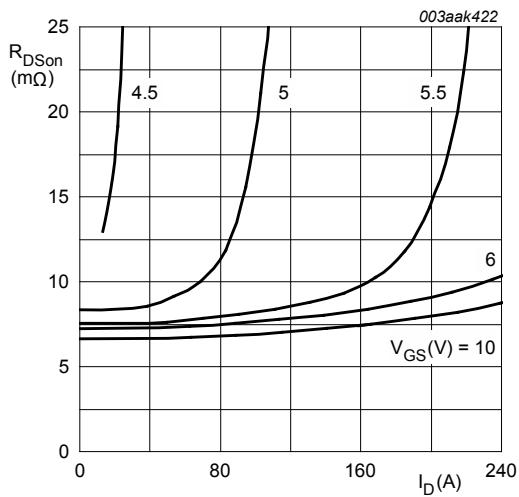


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

$T_j = 25$ °C

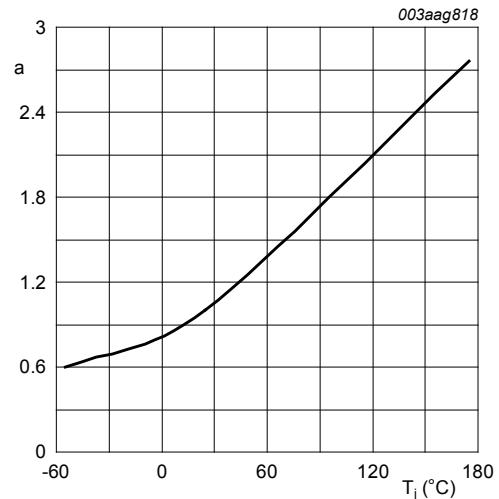


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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

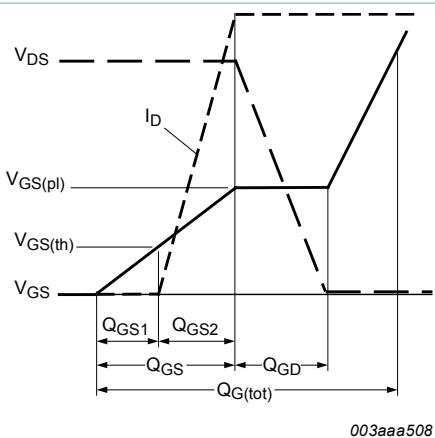


Fig. 14. Gate charge waveform definitions

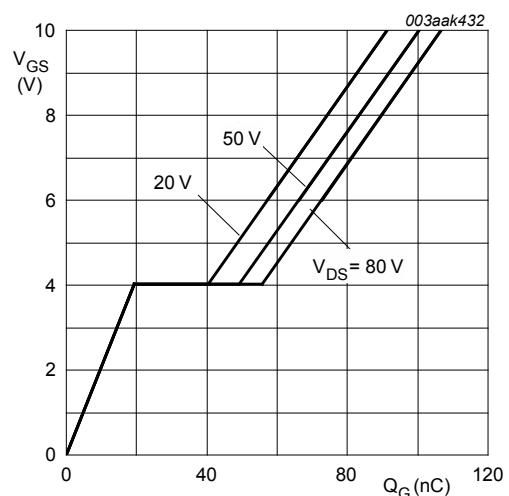


Fig. 15. Gate-source voltage as a function of gate charge; typical values

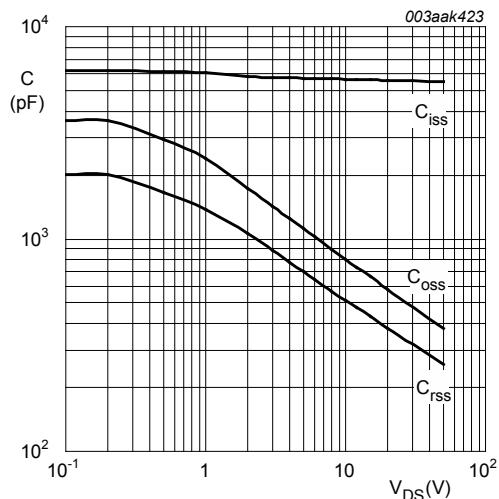
 $T_J = 25^\circ\text{C}; I_D = 10\text{A}$


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

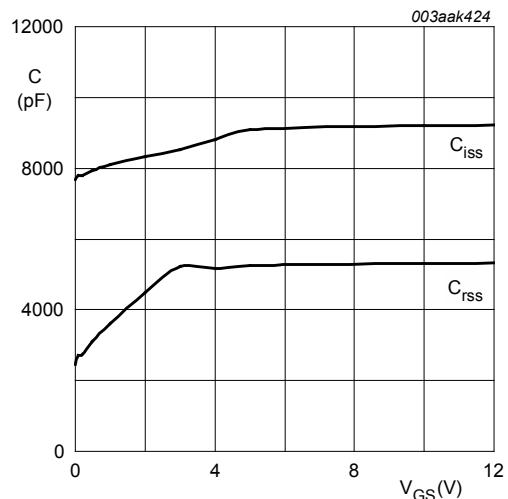
 $V_{GS} = 0\text{V}; f = 1\text{MHz}$


Fig. 17. Input and reverse transfer capacitances as a function of gate-source voltage, typical values

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

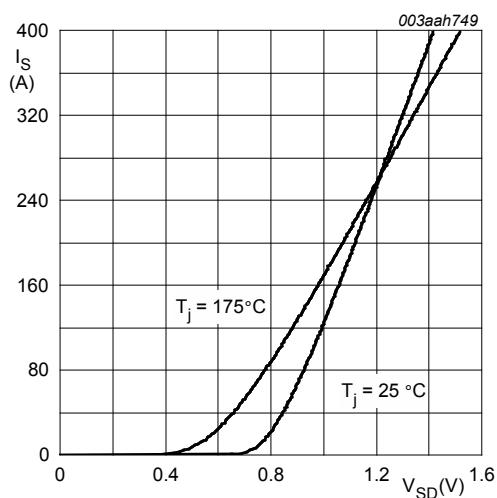


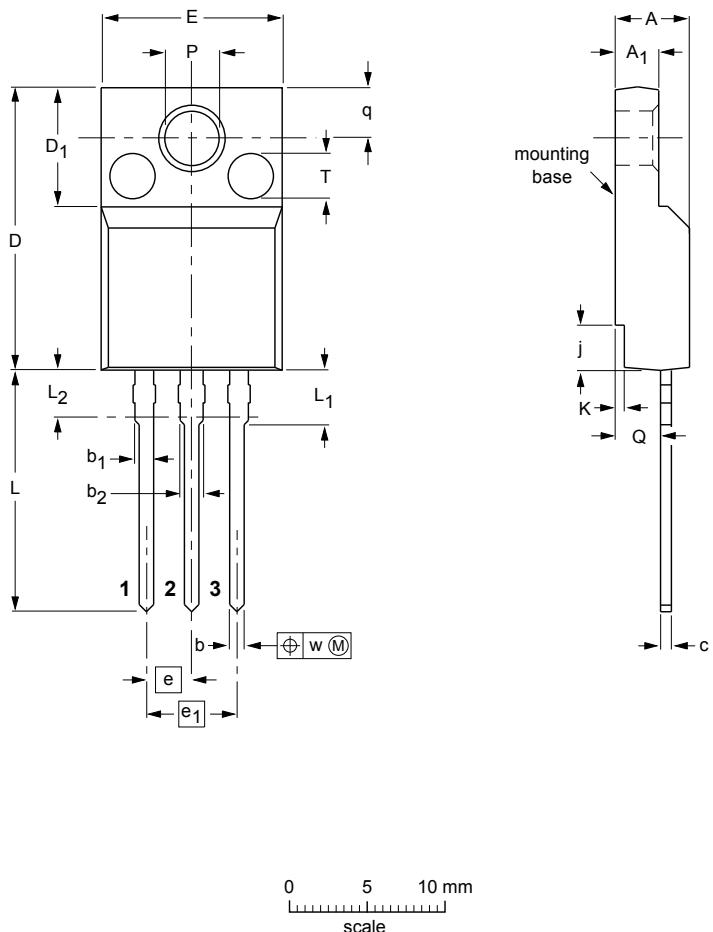
Fig. 18. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

$V_{GS} = 0V$

9. Package outline

Plastic single-ended package; isolated heatsink mounted;
1 mounting hole; 3-lead TO-220 'full pack'

SOT186A



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁	b	b ₁	b ₂	c	D	D ₁	E	e	e ₁	j	K	L	L ₁	L ₂ ⁽¹⁾ max.	P	Q	q	T ⁽²⁾	w
mm	4.6	2.9	0.9	1.1	1.4	0.7	15.8	6.5	10.3	2.54	5.08	2.7	0.6	14.4	3.30	3	3.2	2.6	3.0	2.5	0.4
	4.0	2.5	0.7	0.9	1.0	0.4	15.2	6.3	9.7	2.54	5.08	1.7	0.4	13.5	2.79	3.0	3.0	2.3	2.6	2.5	0.4

Notes

1. Terminal dimensions within this zone are uncontrolled.
2. Both recesses are # 2.5 × 0.8 max. depth

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT186A		3-lead TO-220F				-02-04-09-06-02-14

Fig. 19. Package outline TO-220F (SOT186A)

10. Legal information

10.1 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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