



PSMN016-100XS

N-channel 100V 16 mΩ standard level MOSFET in TO220F (SOT186A)

Rev. 4 — 6 March 2012

Product data sheet

1. Product profile

1.1 General description

Standard level N-channel MOSFET in TO220F (SOT186A) package qualified to 175°C. 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
- Server power supplies
- Motor control
- Synchronous rectification

1.4 Quick reference data

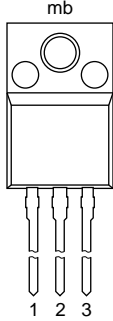
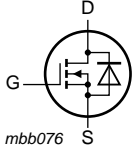
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	-	100	V
I_D	drain current	$T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; see Figure 1	-	-	32.1	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	-	46.1	W
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 10\text{ A}$; $T_j = 25\text{ °C}$; see Figure 12 ; see Figure 13	-	13	16	mΩ
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 10\text{ V}$; $I_D = 10\text{ A}$; $V_{DS} = 50\text{ V}$; see Figure 14 ; see Figure 15	-	14.2	-	nC
$Q_{G(tot)}$	total gate charge		-	46.2	-	nC
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(init)} = 25\text{ °C}$; $I_D = 32.1\text{ A}$; $V_{sup} \leq 100\text{ V}$; unclamped; $R_{GS} = 50\text{ Ω}$; see Figure 3	-	-	138	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		

SOT186A (TO-220F)

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN016-100XS	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"	SOT186A

4. Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	100	V
V_{DGR}	drain-gate voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	100	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 1	-	32.1	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ °C}$; see Figure 1	-	22.7	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$; see Figure 4	-	128	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	46.1	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	$T_{mb} = 25\text{ °C}$	-	38.5	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$	-	128	A

Avalanche ruggedness

$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 32.1\text{ A}$; $V_{sup} \leq 100\text{ V}$; unclamped; $R_{GS} = 50\text{ }\Omega$; see Figure 3	-	138	mJ
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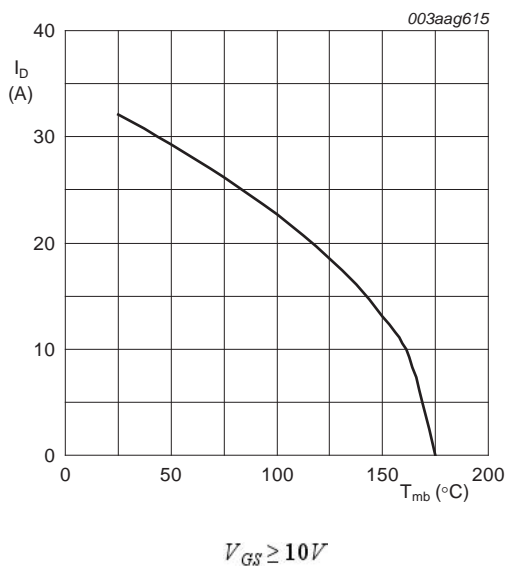


Fig 1. Continuous drain current as a function of mounting base temperature

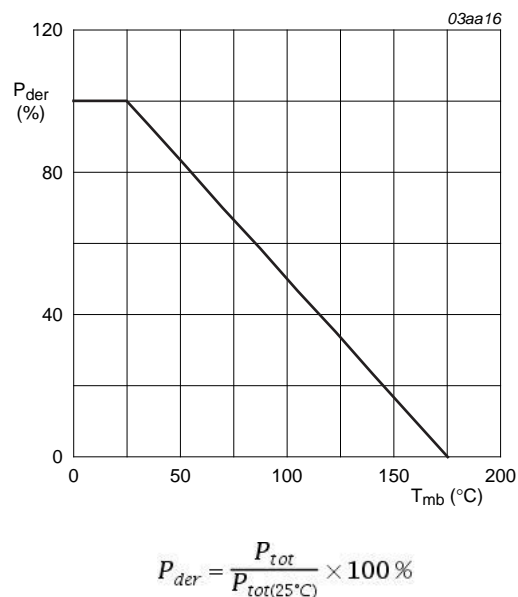


Fig 2. Normalized total power dissipation as a function of mounting base temperature

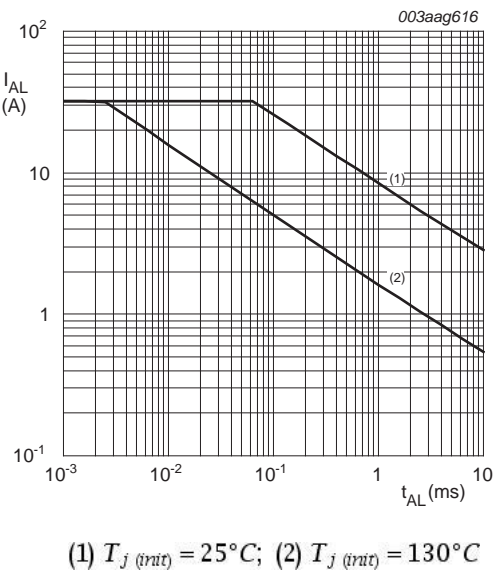


Fig 3. Single pulse avalanche rating; avalanche current as a function of avalanche time

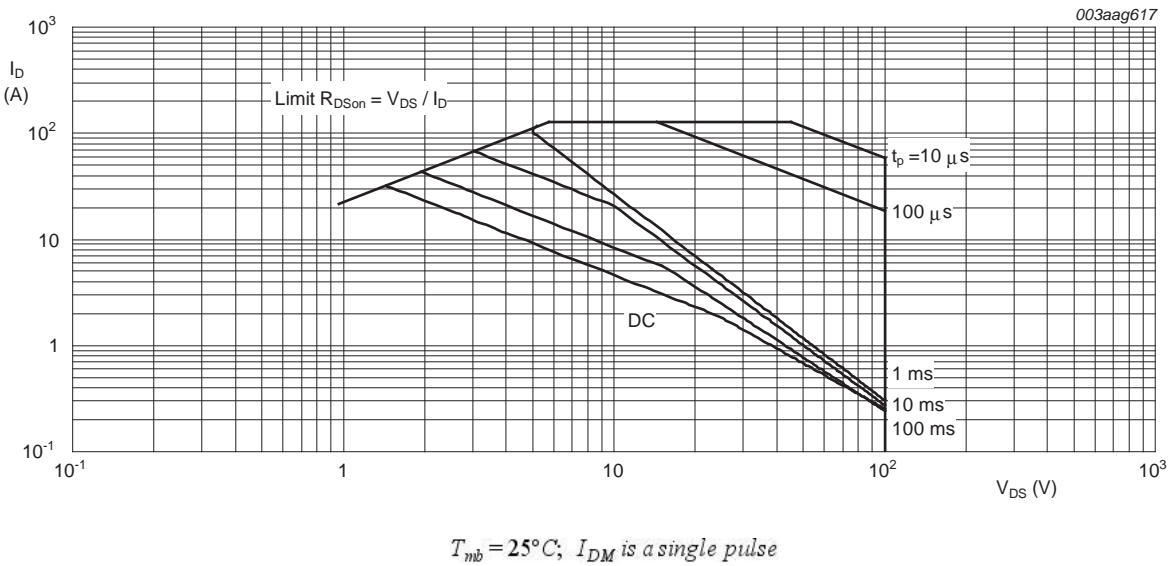


Fig 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 5	-	3	3.25	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in free air	-	55	-	K/W

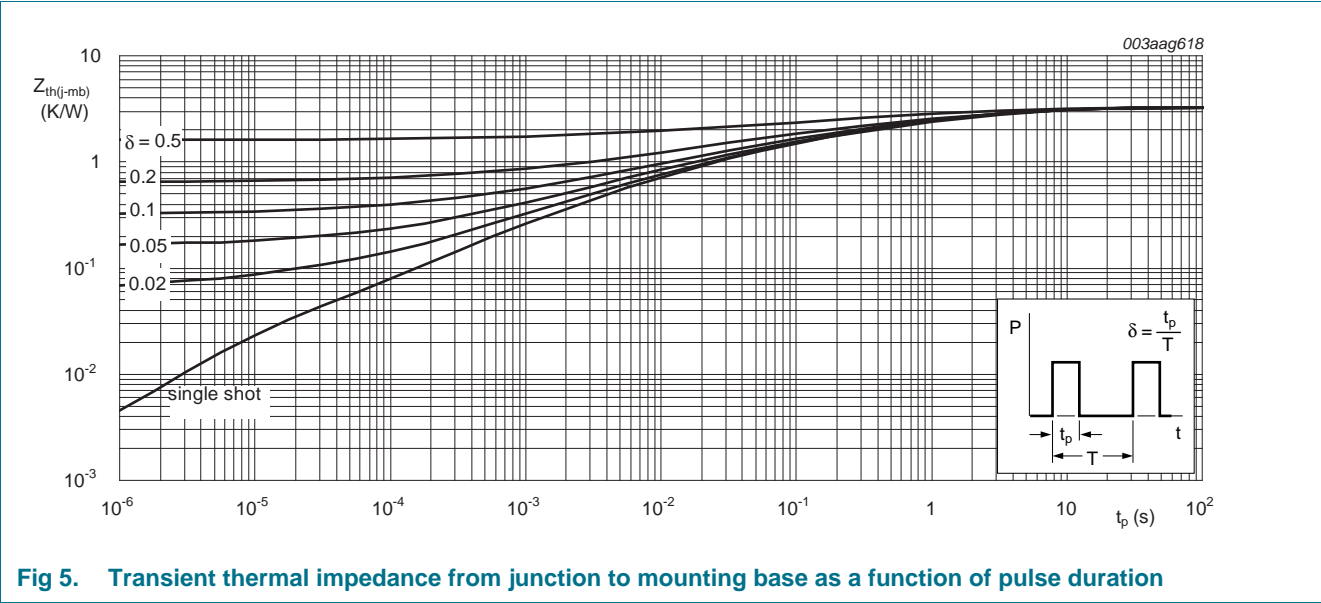


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Isolation characteristics

Table 6. Isolation characteristics

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

7. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	100	-	-	V
		$I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$; $T_j = -55\ ^\circ\text{C}$	90	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_j = 25\ ^\circ\text{C}$; see Figure 10 ; see Figure 11	2	3	4	V
		$I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_j = 175\ ^\circ\text{C}$; see Figure 10	1	-	-	V
		$I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_j = -55\ ^\circ\text{C}$; see Figure 10	-	-	4.6	V
I_{DSS}	drain leakage current	$V_{DS} = 100\ \text{V}$; $V_{GS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	-	-	5	μA
		$V_{DS} = 100\ \text{V}$; $V_{GS} = 0\ \text{V}$; $T_j = 100\ ^\circ\text{C}$	-	-	100	μA
I_{GSS}	gate leakage current	$V_{GS} = 20\ \text{V}$; $V_{DS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	-	2	100	nA
		$V_{GS} = -20\ \text{V}$; $V_{DS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\ \text{V}$; $I_D = 10\ \text{A}$; $T_j = 25\ ^\circ\text{C}$; see Figure 12 ; see Figure 13	-	13	16	mΩ
		$V_{GS} = 10\ \text{V}$; $I_D = 10\ \text{A}$; $T_j = 100\ ^\circ\text{C}$; see Figure 13	-	22.8	28	mΩ
		$V_{GS} = 10\ \text{V}$; $I_D = 10\ \text{A}$; $T_j = 175\ ^\circ\text{C}$; see Figure 13	-	36.4	44.8	mΩ
R_G	internal gate resistance (AC)	$f = 1\ \text{MHz}$	-	0.9	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 10\ \text{A}$; $V_{DS} = 50\ \text{V}$; $V_{GS} = 10\ \text{V}$; see Figure 14 ; see Figure 15	-	46.2	-	nC
Q_{GS}	gate-source charge		-	10.4	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	7.1	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	3.3	-	nC
Q_{GD}	gate-drain charge		-	14.2	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 10\ \text{A}$; $V_{DS} = 50\ \text{V}$; see Figure 14 ; see Figure 15	-	4.5	-	V
C_{iss}	input capacitance	$V_{DS} = 50\ \text{V}$; $V_{GS} = 0\ \text{V}$; $f = 1\ \text{MHz}$; $T_j = 25\ ^\circ\text{C}$; see Figure 16 ; see Figure 17	-	2404	-	pF
C_{oss}	output capacitance	$V_{DS} = 50\ \text{V}$; $V_{GS} = 0\ \text{V}$; $f = 1\ \text{MHz}$; $T_j = 25\ ^\circ\text{C}$; see Figure 16	-	189	-	pF
C_{rss}	reverse transfer capacitance	$V_{DS} = 50\ \text{V}$; $V_{GS} = 0\ \text{V}$; $f = 1\ \text{MHz}$; $T_j = 25\ ^\circ\text{C}$; see Figure 16 ; see Figure 17	-	113	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 50\ \text{V}$; $R_L = 5\ \Omega$; $V_{GS} = 10\ \text{V}$; $R_{G(ext)} = 4.7\ \Omega$; $T_j = 25\ ^\circ\text{C}$	-	16	-	ns
t_r	rise time		-	16	-	ns
$t_{d(off)}$	turn-off delay time		-	39	-	ns
t_f	fall time		-	18	-	ns

Table 7. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 10\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ °C}$	-	0.8	1.2	V
t_{rr}	reverse recovery time	$I_S = 10\text{ A}$; $di_S/dt = -100\text{ A}/\mu\text{s}$;	-	54	-	ns
Q_r	recovered charge	$V_{GS} = 0\text{ V}$; $V_{DS} = 50\text{ V}$	-	126	-	nC

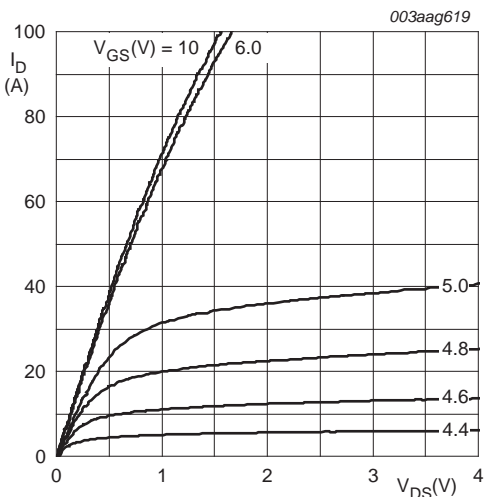


Fig 6. Output characteristics; drain current as a function of drain-source voltage; typical values

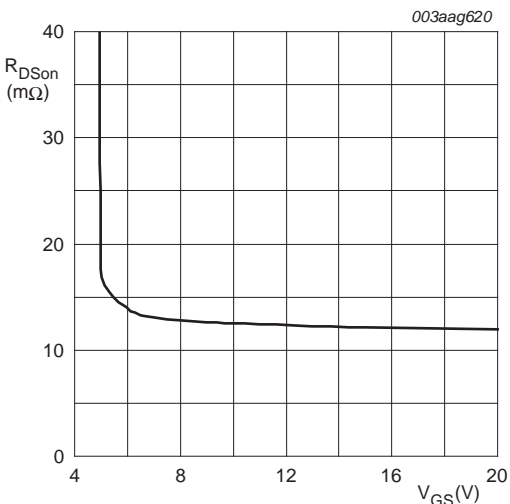


Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

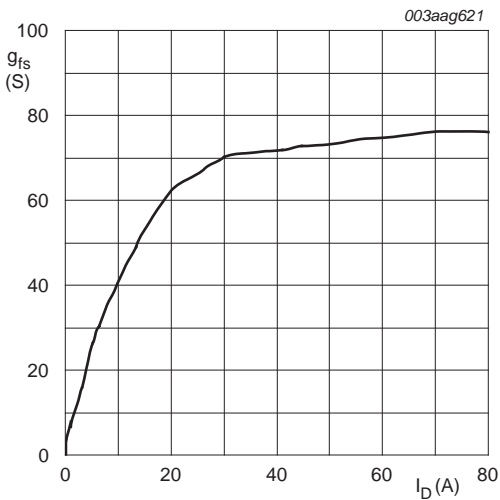


Fig 8. Forward transconductance as a function of drain current; typical values

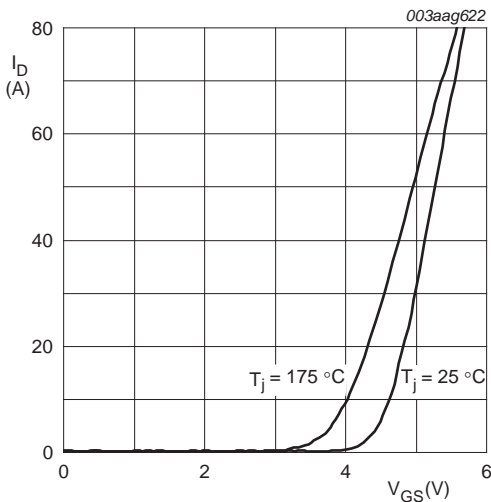
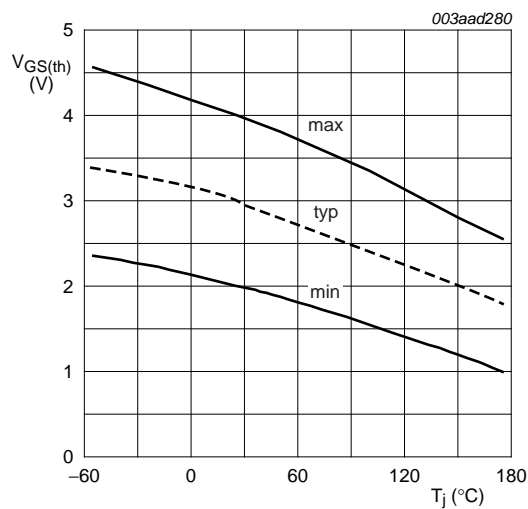
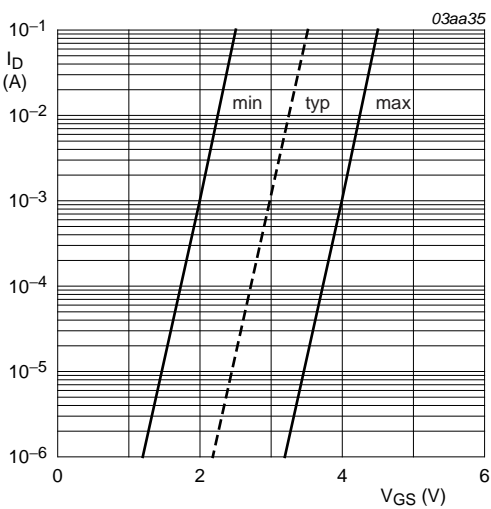


Fig 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values



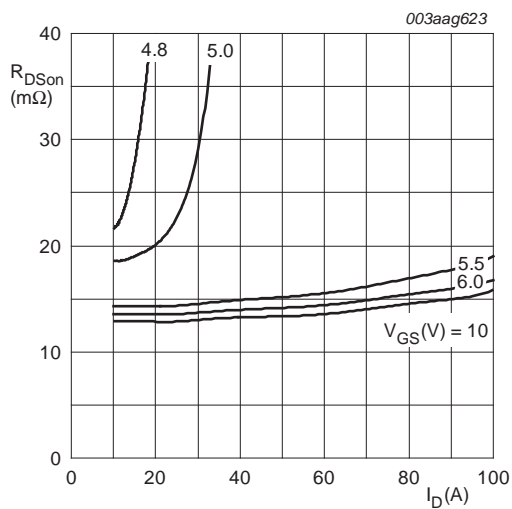
$I_D = 1\text{ mA}; V_{DS} = V_{GS}$

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



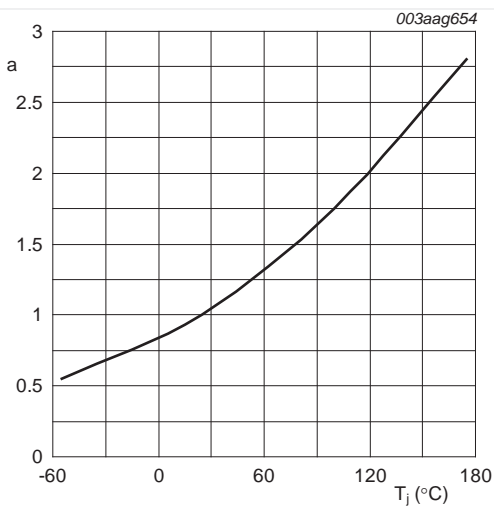
$T_j = 25\text{ }^{\circ}\text{C}; V_{DS} = 5\text{ V}$

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



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

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



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

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

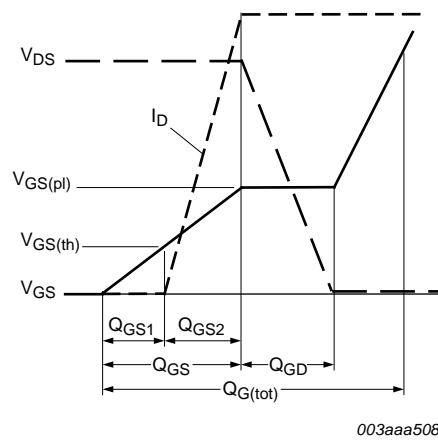
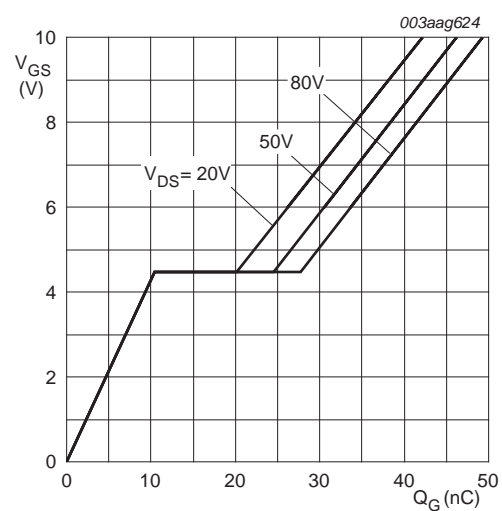
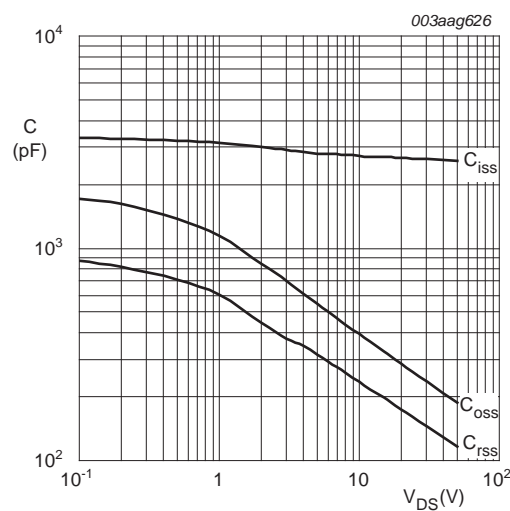


Fig 14. Gate charge waveform definitions



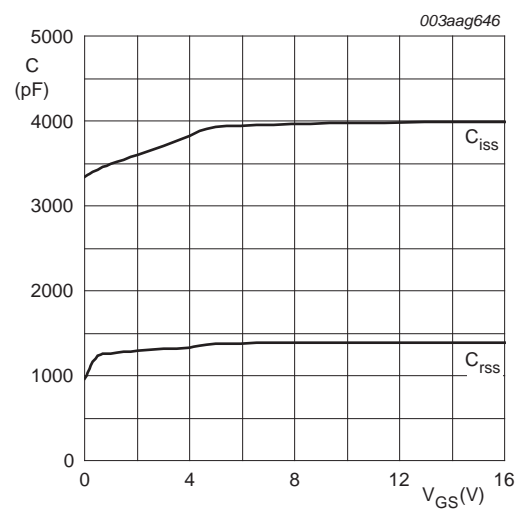
$T_j = 25^{\circ}C; I_D = 10A$

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



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

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



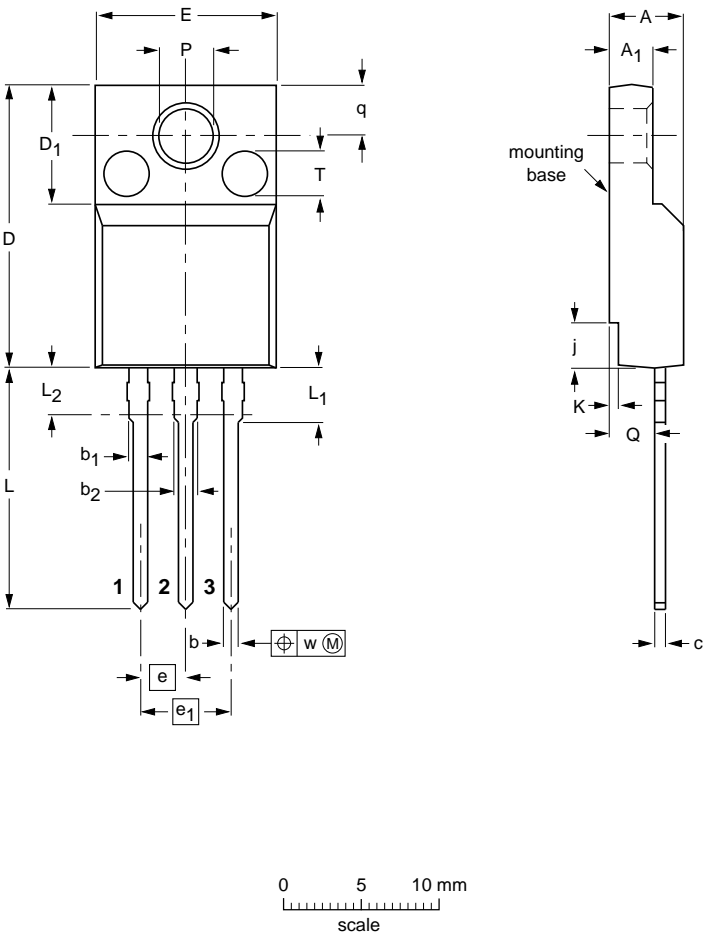
$f = 1MHz; V_{DS} = 0V$

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

8. 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 4.0	2.9 2.5	0.9 0.7	1.1 0.9	1.4 1.0	0.7 0.4	15.8 15.2	6.5 6.3	10.3 9.7	2.54	5.08	2.7 1.7	0.6 0.4	14.4 13.5	3.30 2.79	3	3.2 3.0	2.6 2.3	3.0 2.6	2.5	0.4

Notes

1. Terminal dimensions within this zone are uncontrolled.
2. Both recesses are $\varnothing 2.5 \times 0.8$ max. depth

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

Fig 18. Package outline SOT186A (TO-220F)

9. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN016-100XS v.4	20120306	Product data sheet	-	PSMN016-100XS v.3
Modifications:	<ul style="list-style-type: none">• Status changed from preliminary to product.• Various changes to content.			
PSMN016-100XS v.3	20111021	Preliminary data sheet	-	PSMN016-100XS v.2

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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12. Contents

1	Product profile	1
1.1	General description	1
1.2	Features and benefits	1
1.3	Applications	1
1.4	Quick reference data	1
2	Pinning information	2
3	Ordering information	2
4	Limiting values	3
5	Thermal characteristics	5
6	Isolation characteristics	5
7	Characteristics	6
8	Package outline	10
9	Revision history	11
10	Legal information	12
10.1	Data sheet status	12
10.2	Definitions	12
10.3	Disclaimers	12
10.4	Trademarks	13
11	Contact information	13

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