



PSMN9R5-100PS

N-channel 100 V 9.6 mΩ standard level MOSFET in T0220

17 October 2013

Product data sheet

1. General description

Standard level N-channel MOSFET in a TO220 packages qualified to 175C. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

2. Features and benefits

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

3. Applications

- DC-to-DC converters
- Load switching
- Motor control
- Server power supplies

4. Quick reference data

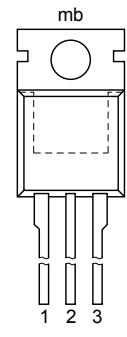
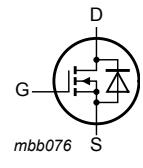
Table 1. Quick reference data

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		-	-	89	A
P_{tot}	total power dissipation	$T_{mb} = 25 \text{ }^\circ\text{C}$; Fig. 2		-	-	211	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$; Fig. 13		-	8.16	9.6	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	$V_{GS} = 10 \text{ V}; I_D = 60 \text{ A}; V_{DS} = 50 \text{ V}$; Fig. 14 ; Fig. 15		-	23	-	nC
$Q_{G(tot)}$	total gate charge			-	82	-	nC
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10 \text{ V}; T_{j(init)} = 25 \text{ }^\circ\text{C}; I_D = 89 \text{ A}$; $V_{sup} \leq 100 \text{ V}$; unclamped; $R_{GS} = 50 \Omega$		-	-	177	mJ

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5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate		
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain	 TO-220AB (SOT78)	

6. Ordering information

Table 3. Ordering information

Type number	Package			Version
	Name	Description		
PSMN9R5-100PS	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB		SOT78

7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN9R5-100PS	PSMN9R5-100PS

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	$T_j \geq 25^\circ\text{C}$; $T_j \leq 175^\circ\text{C}$	-	100	V
V_{DGR}	drain-gate voltage	$T_j \leq 175^\circ\text{C}$; $T_j \geq 25^\circ\text{C}$; $R_{GS} = 20\text{ k}\Omega$	-	100	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 100^\circ\text{C}$; Fig. 1	-	63	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 25^\circ\text{C}$; Fig. 1	-	89	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25^\circ\text{C}$; Fig. 3	-	355	A

Symbol	Parameter	Conditions	Min	Max	Unit
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 2	-	211	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 °C	-	89	A
I _{SM}	peak source current	pulsed; t _p ≤ 10 µs; T _{mb} = 25 °C	-	355	A
Avalanche ruggedness					
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	V _{GS} = 10 V; T _{j(init)} = 25 °C; I _D = 89 A; V _{sup} ≤ 100 V; unclamped; R _{GS} = 50 Ω	-	177	mJ

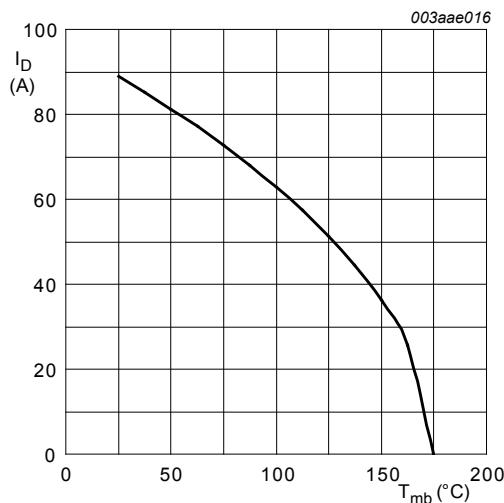


Fig. 1. Continuous drain current as a function of mounting base temperature

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

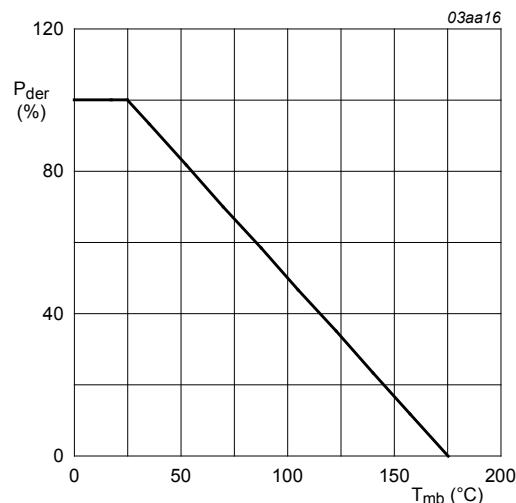


Fig. 2. Normalized total power dissipation as a function of mounting base temperature

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

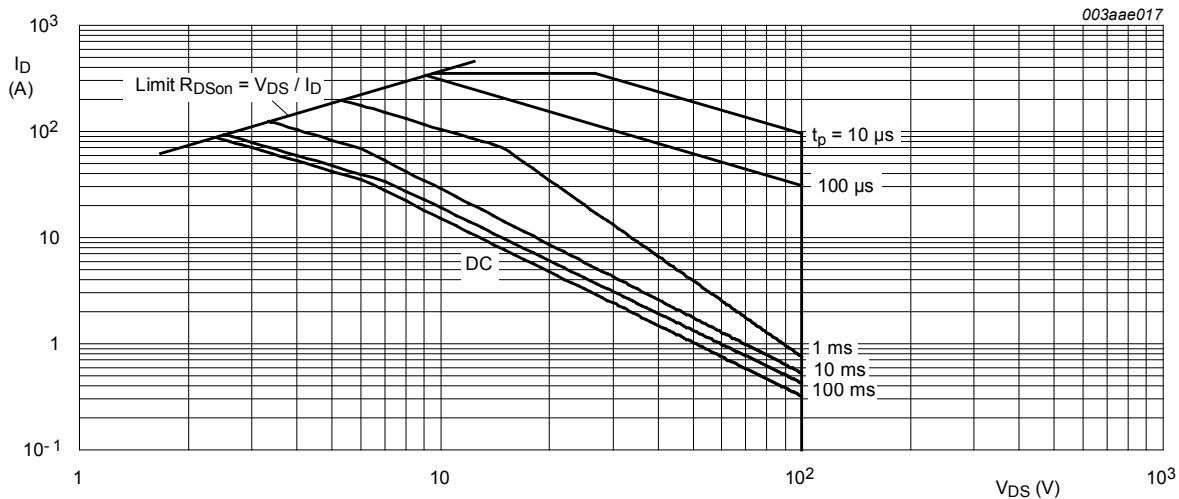


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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

9. 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. 4	-	0.38	0.71	K/W

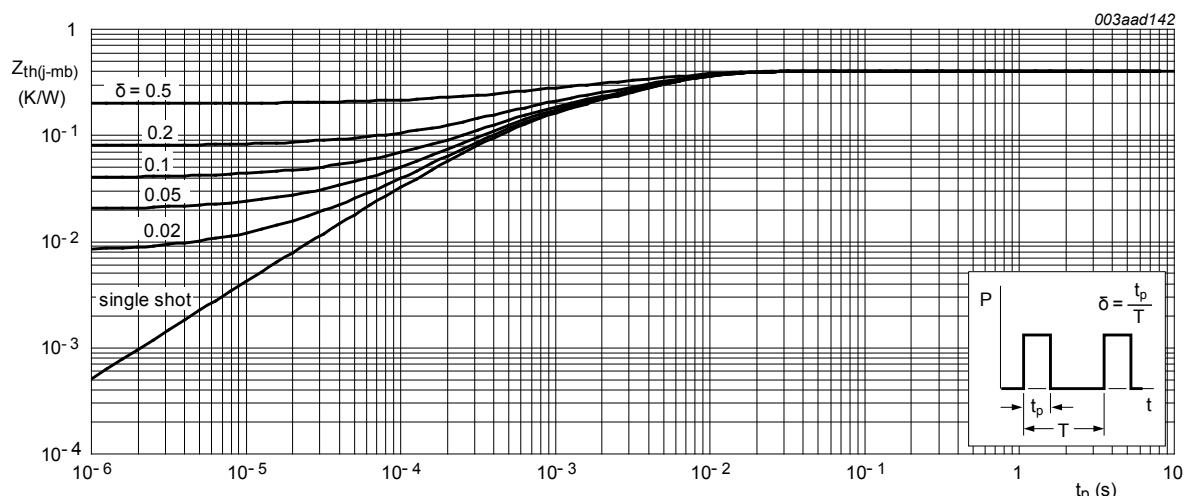


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
V _{(BR)DSS}	drain-source breakdown voltage	I _D = 0.25 mA; V _{GS} = 0 V; T _j = -55 °C		90	-	-	V
		I _D = 0.25 mA; V _{GS} = 0 V; T _j = 25 °C		100	-	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 1 mA; V _{DS} = V _{GS} ; T _j = 175 °C; Fig. 10 ; Fig. 11		1	-	-	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _j = 25 °C; Fig. 10 ; Fig. 11		2	3	4	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _j = -55 °C; Fig. 10 ; Fig. 11		-	-	4.8	V
I _{DSS}	drain leakage current	V _{DS} = 100 V; V _{GS} = 0 V; T _j = 125 °C		-	-	100	μA
		V _{DS} = 100 V; V _{GS} = 0 V; T _j = 25 °C		-	0.02	4	μA
I _{GSS}	gate leakage current	V _{GS} = 20 V; V _{DS} = 0 V; T _j = 25 °C		-	10	100	nA
		V _{GS} = -20 V; V _{DS} = 0 V; T _j = 25 °C		-	10	100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 15 A; T _j = 100 °C; Fig. 12		-	-	17.3	mΩ
		V _{GS} = 10 V; I _D = 15 A; T _j = 175 °C; Fig. 12		-	23.5	27.4	mΩ
		V _{GS} = 10 V; I _D = 15 A; T _j = 25 °C; Fig. 13		-	8.16	9.6	mΩ
R _G	internal gate resistance (AC)	f = 1 MHz		-	0.7	-	Ω
Dynamic characteristics							
Q _{G(tot)}	total gate charge	I _D = 0 A; V _{DS} = 0 V; V _{GS} = 10 V; Fig. 14		-	67	-	nC
		I _D = 60 A; V _{DS} = 50 V; V _{GS} = 10 V; Fig. 14 ; Fig. 15		-	82	-	nC
Q _{GS}	gate-source charge			-	21	-	nC
Q _{GS(th)}	pre-threshold gate-source charge	I _D = 60 A; V _{DS} = 50 V; V _{GS} = 3 V; Fig. 14		-	13.1	-	nC
Q _{GS(th-pl)}	post-threshold gate-source charge	I _D = 60 A; V _{DS} = 50 V; V _{GS} = 10 V; Fig. 14		-	7.8	-	nC
Q _{GD}	gate-drain charge	I _D = 60 A; V _{DS} = 50 V; V _{GS} = 10 V; Fig. 14 ; Fig. 15		-	23	-	nC
V _{GS(pl)}	gate-source plateau voltage	V _{DS} = 50 V; Fig. 14 ; Fig. 15		-	4.5	-	V
C _{iss}	input capacitance	V _{DS} = 50 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C; Fig. 16		-	4454	-	pF
C _{oss}	output capacitance			-	302	-	pF

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{rss}	reverse transfer capacitance		-	185	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 50$ V; $R_L = 0.8$ Ω; $V_{GS} = 10$ V; $R_{G(ext)} = 4.7$ Ω; $T_j = 25$ °C	-	22	-	ns
t_r	rise time		-	25.2	-	ns
$t_{d(off)}$	turn-off delay time		-	52.2	-	ns
t_f	fall time		-	22.8	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 15$ A; $V_{GS} = 0$ V; $T_j = 25$ °C; Fig. 17	-	0.85	1.2	V
t_{rr}	reverse recovery time	$I_S = 20$ A; $dI_S/dt = 100$ A/μs; $V_{GS} = 0$ V; $V_{DS} = 50$ V	-	61.5	-	ns
Q_r	recovered charge		-	157	-	nC

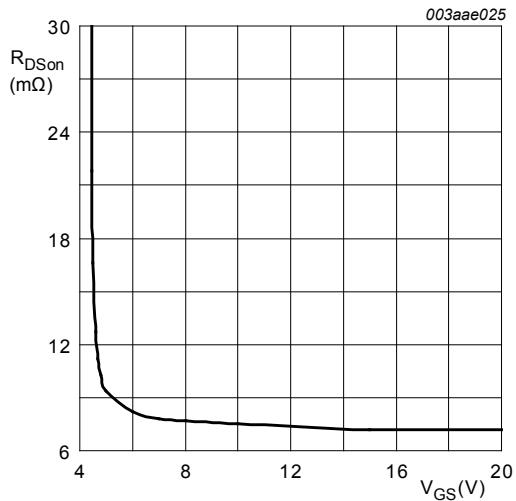


Fig. 5. Drain-source on-state resistance as a function of gate-source voltage; typical values.

$T_j = 25$ °C; $I_D = 20$ A

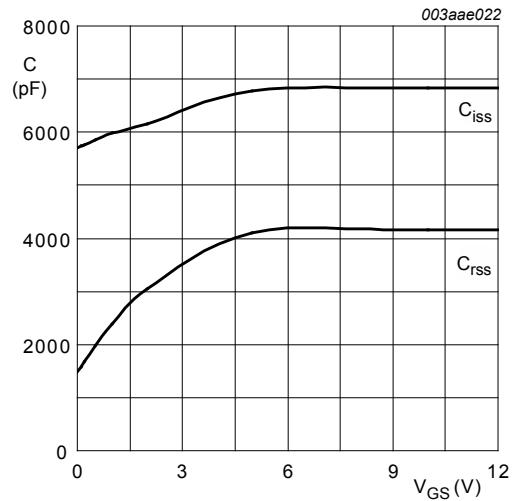


Fig. 6. Input and reverse transfer capacitances as a function of gate-source voltage; typical values

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

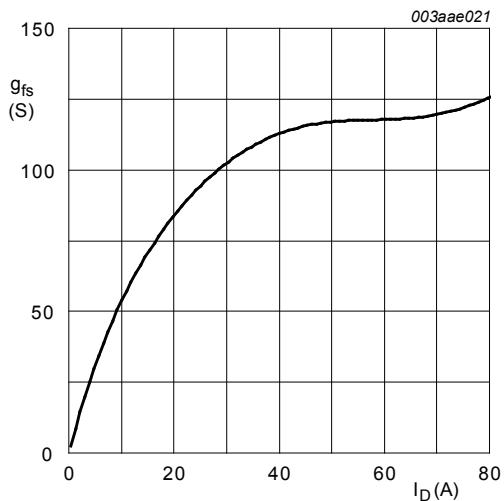


Fig. 7. Forward transconductance as a function of drain current; typical values

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

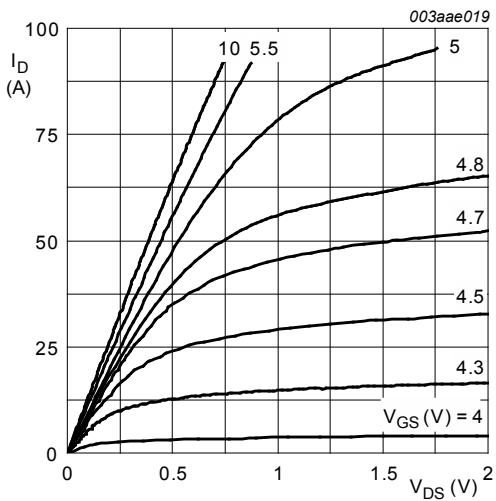


Fig. 8. Output characteristics: drain current as a function of drain-source voltage; typical values

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

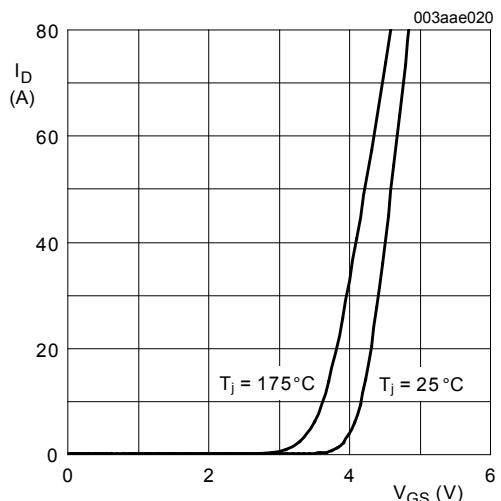


Fig. 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values

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

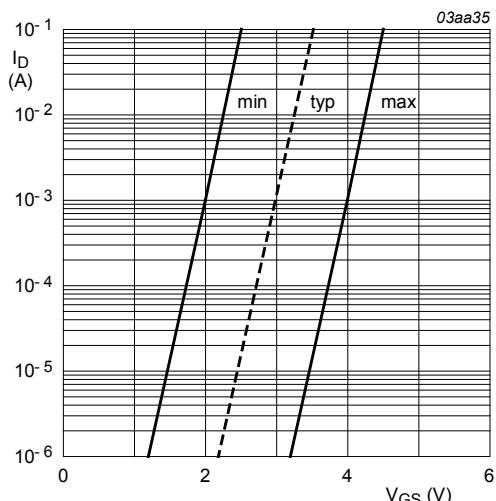


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

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

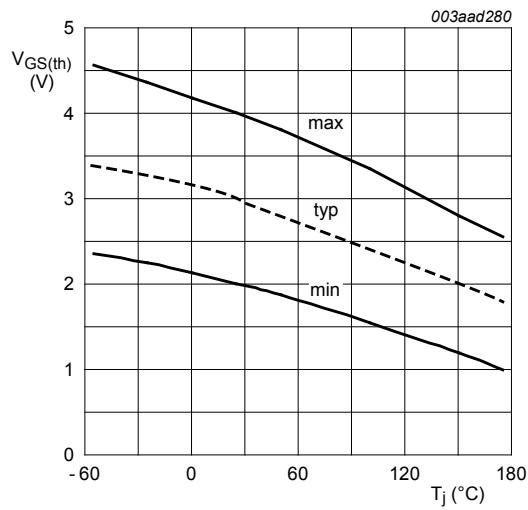


Fig. 11. Gate-source threshold voltage as a function of junction temperature

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

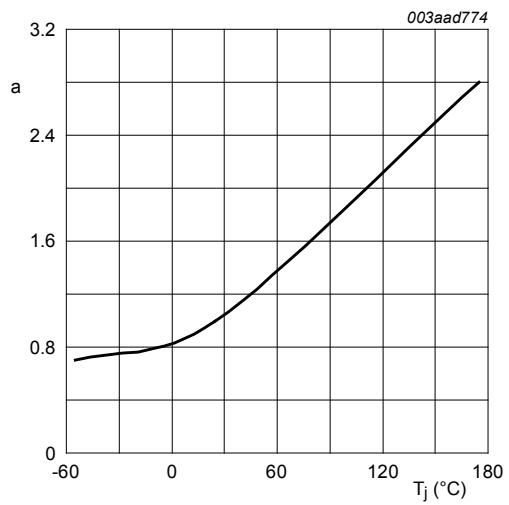


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

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

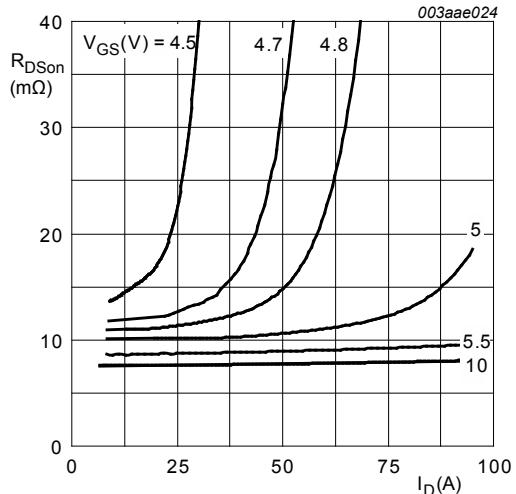


Fig. 13. Drain-source on-state resistance as a function of drain current; typical values

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

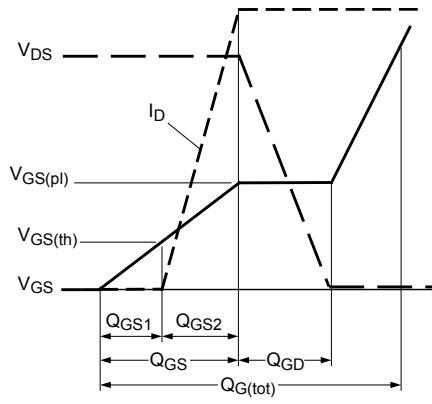


Fig. 14. Gate charge waveform definitions

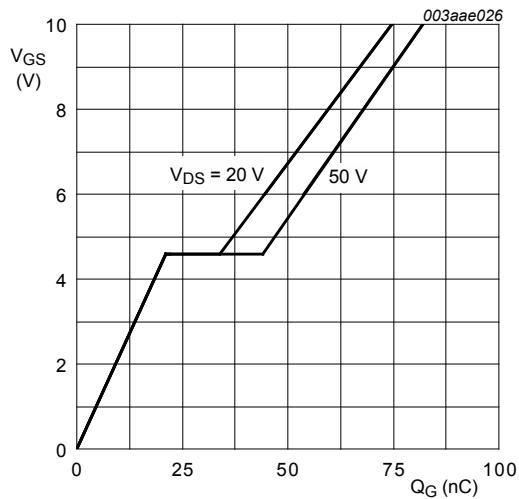


Fig. 15. Gate-source voltage as a function of gate charge; typical values

$T_j = 25^\circ\text{C}$; $I_D = 60 \text{ A}$

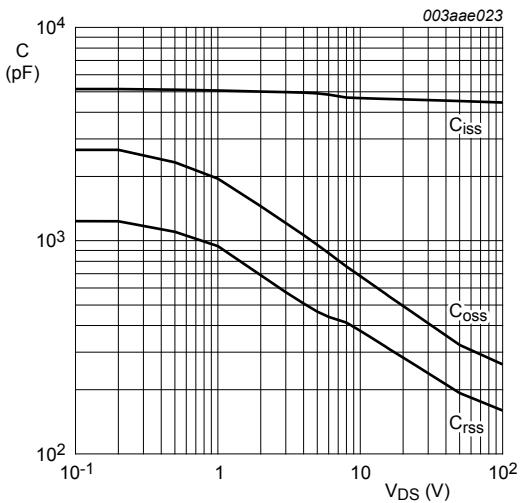


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

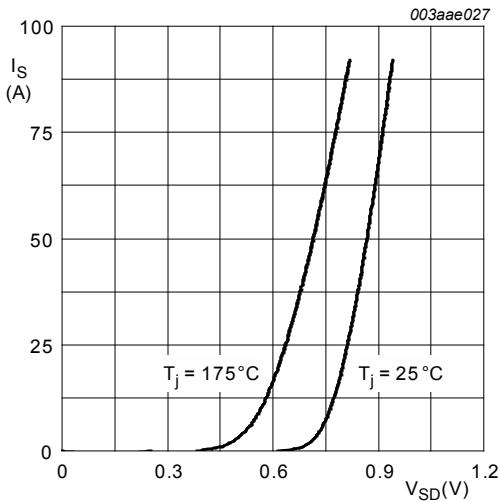
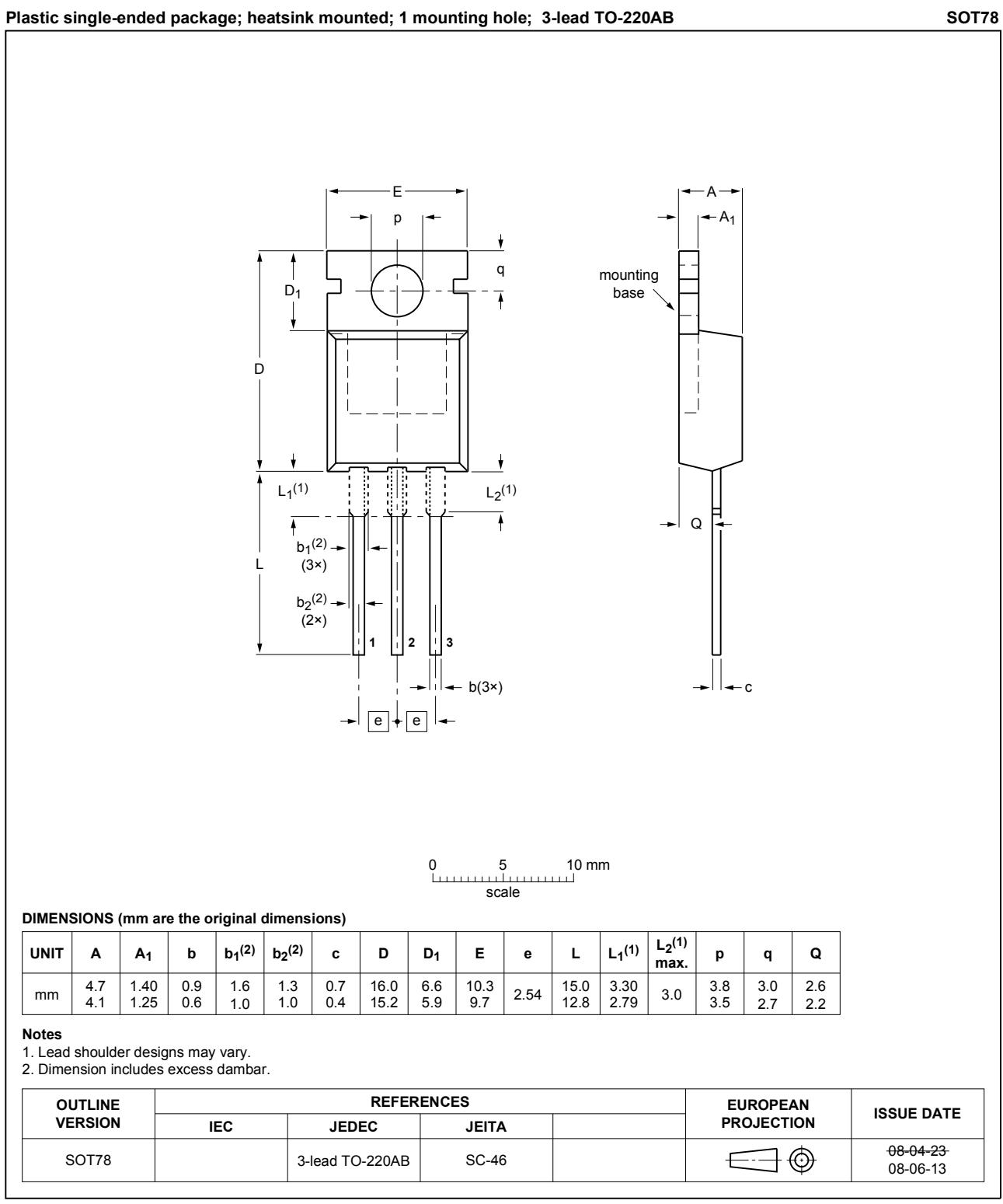


Fig. 17. Source current as a function of source-drain voltage; typical values

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

11. Package outline



12. Legal information

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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.
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