



# PSMN8R5-100PSF

NextPower 100 V, 8.7 mΩ N-channel MOSFET in TO220 package

10 April 2017

Product data sheet

## 1. General description

NextPower 100 V standard level gate drive MOSFET. Qualified to 175 °C and recommended for industrial & consumer applications.

## 2. Features and benefits

- Optimised for fast switching, low spiking, high efficiency
- Low  $Q_G \times R_{DSon}$  FOM for high efficiency switching applications
- Low body diode losses ( $Q_{rr}$ ) and fast recovery ( $t_{rr}$ )
- Strong avalanche energy rating ( $E_{AS}$ )
- Avalanche rated & 100% tested
- Ha-free & RoHS compliant TO220 package

## 3. Applications

- Synchronous rectification in AC-to-DC and DC-to-DC applications
- Brushed & BLDC motor control
- UPS & solar inverter
- LED lighting
- Battery protection
- Full-bridge & half-bridge applications
- Flyback & resonant topologies

## 4. Quick reference data

Table 1. Quick reference data

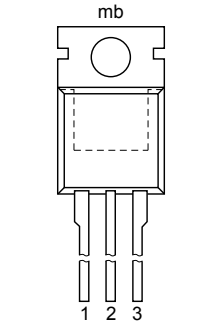
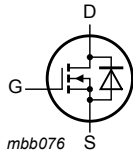
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$	-	-	100	V
$I_D$	drain current	$V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 2</a>	[1]	-	98	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 1</a>	-	-	183	W
$T_j$	junction temperature		-55	-	175	°C
<b>Static characteristics</b>						
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 10</a>	-	7.5	8.7	mΩ
		$V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$ ; $T_j = 100\text{ °C}$ ; <a href="#">Fig. 11</a>	-	11.2	13.5	mΩ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$I_D = 25\text{ A}$ ; $V_{DS} = 50\text{ V}$ ; $V_{GS} = 10\text{ V}$ ; <a href="#">Fig. 12</a> ; <a href="#">Fig. 13</a>	-	8.7	-	nC
$Q_{G(tot)}$	total gate charge		-	44.5	-	nC

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
<b>Avalanche ruggedness</b>							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 34\text{ A}$ ; $V_{sup} \leq 100\text{ V}$ ; $R_{GS} = 50\ \Omega$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; Fig. 4; Unclamped	[2]	-	-	281	mJ

- [1] Avalanche current is limited by  $I_{AS}$
- [2] Protected by 100% test

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p style="text-align: center;"><b>TO-220AB (SOT78)</b></p>	 <p style="text-align: center;"><i>mbb076</i></p>
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PSMN8R5-100PSF	TO-220AB	plastic, single-ended package (heatsink mounted, 1 mounting hole); 3 leads; 2.54 mm pitch; 15.6 mm x 10 mm x 4.4 mm body	SOT78

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN8R5-100PSF	PSMN8R5-100PSF

## 8. Limiting values

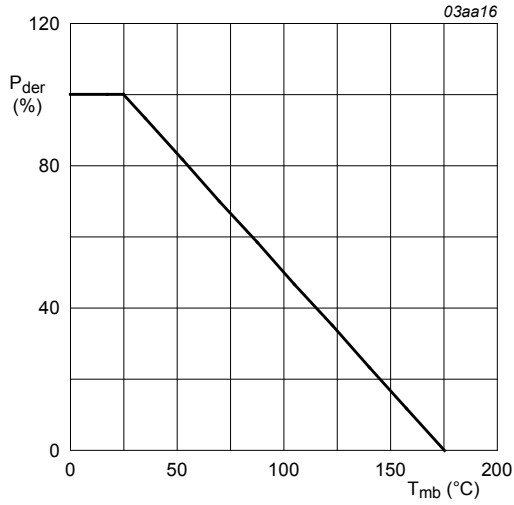
**Table 5. Limiting values**

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

Symbol	Parameter	Conditions		Min	Max	Unit
$V_{DS}$	drain-source voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$		-	100	V
$V_{DGR}$	drain-gate voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$ ; $R_{GS} = 20\text{ k}\Omega$		-	100	V
$V_{GS}$	gate-source voltage			-20	20	V
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 1</a>		-	183	W
$I_D$	drain current	$V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 2</a>	[1]	-	98	A
		$V_{GS} = 10\text{ V}$ ; $T_{mb} = 100\text{ °C}$ ; <a href="#">Fig. 2</a>		-	69	A
$I_{DM}$	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 3</a>		-	391	A
$T_{stg}$	storage temperature			-55	175	°C
$T_j$	junction temperature			-55	175	°C
$T_{sld(M)}$	peak soldering temperature			-	260	°C
<b>Source-drain diode</b>						
$I_S$	source current	$T_{mb} = 25\text{ °C}$		-	98	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$		-	391	A
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 34\text{ A}$ ; $V_{sup} \leq 100\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; <a href="#">Fig. 4</a> ; Unclamped	[2]	-	281	mJ
$I_{AS}$	non-repetitive avalanche current	$V_{sup} \leq 100\text{ V}$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; $R_{GS} = 50\text{ }\Omega$	[2]	-	34	A

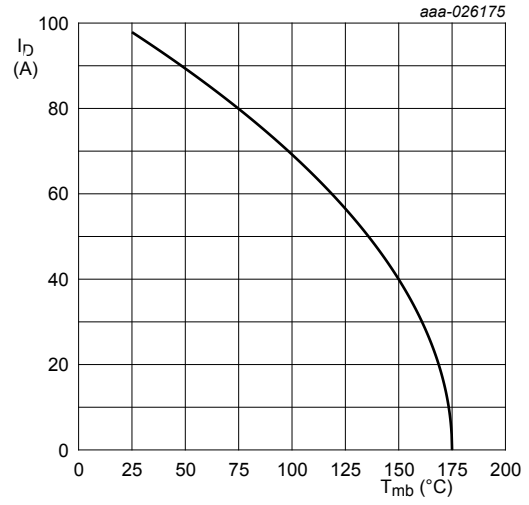
[1] Avalanche current is limited by  $I_{AS}$

[2] Protected by 100% test



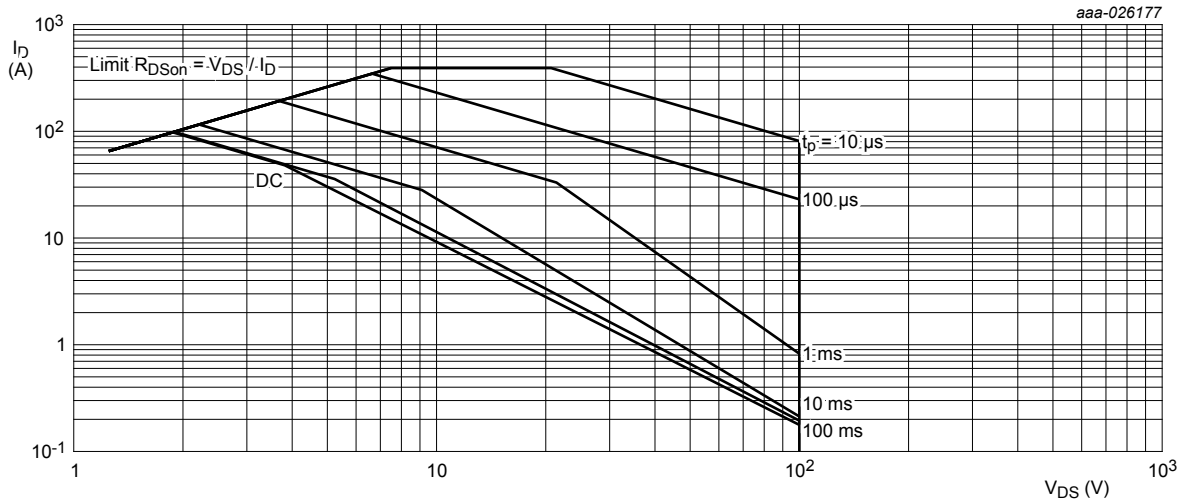
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

**Fig. 1. Normalized total power dissipation as a function of mounting base temperature**



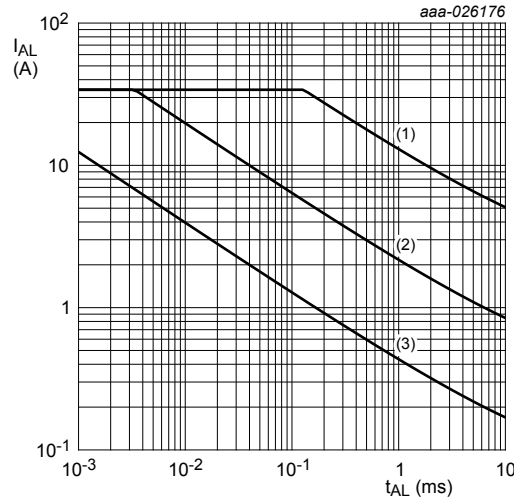
$V_{GS} \geq 10\text{ V}$

**Fig. 2. Continuous drain current as a function of mounting base temperature**



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

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



(1)  $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$ ; (2)  $T_{j(\text{init})} = 150\text{ }^\circ\text{C}$ ; (3) Repetitive Avalanche

Fig. 4. Avalanche rating; avalanche current as a function of avalanche time

## 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. 5	-	0.71	0.82	K/W

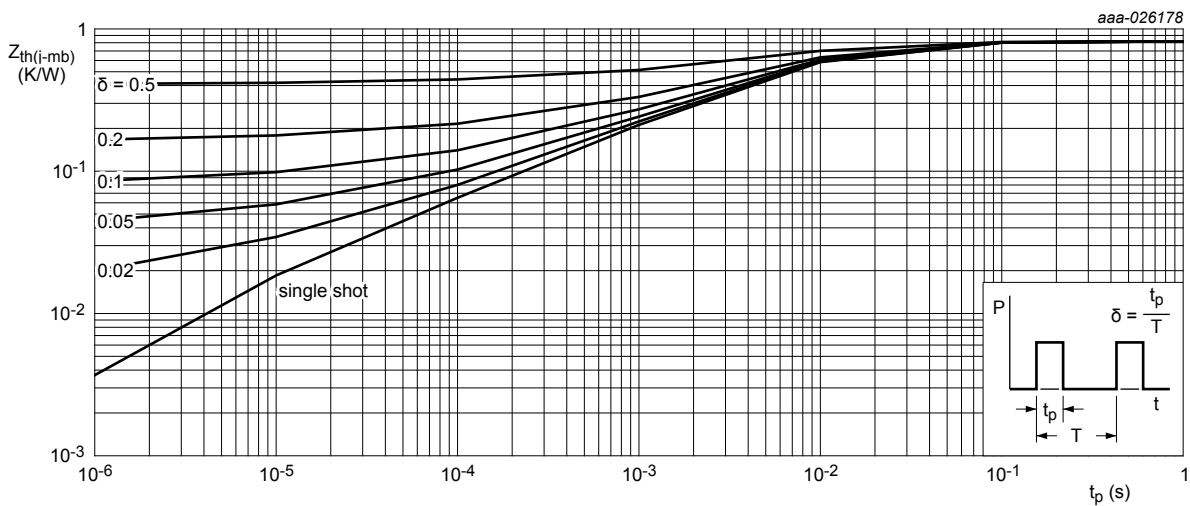


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	100	-	-	V
		$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	90	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = -55 \text{ }^\circ\text{C}$	-	3.6	-	V
		$I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = 175 \text{ }^\circ\text{C}$	-	1.8	-	V
		$I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = 25 \text{ }^\circ\text{C}; \text{Fig. 9}$	2	3.1	4	V
$\Delta V_{GS(th)}/\Delta T$	gate-source threshold voltage variation with temperature	$25 \text{ }^\circ\text{C} \leq T_j \leq 175 \text{ }^\circ\text{C}$	-	-8.4	-	mV/K
$I_{DSS}$	drain leakage current	$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.05	1	$\mu\text{A}$
		$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ\text{C}$	-	-	100	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	5	100	nA
		$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	5	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}; \text{Fig. 10}$	-	7.5	8.7	mΩ
		$V_{GS} = 7 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}; \text{Fig. 10}$	-	8.9	13.2	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 100 \text{ }^\circ\text{C}; \text{Fig. 11}$	-	11.2	13.5	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ\text{C}; \text{Fig. 11}$	-	16	19	mΩ
$R_G$	gate resistance	$f = 1 \text{ MHz}$	-	1.54	-	Ω
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 25 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V}; \text{Fig. 12}; \text{Fig. 13}$	-	44.5	-	nC
		$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$	-	22.9	-	nC
$Q_{GS}$	gate-source charge	$I_D = 25 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V}; \text{Fig. 12}; \text{Fig. 13}$	-	14.5	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	8.8	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	5.6	-	nC
$Q_{GD}$	gate-drain charge		-	8.7	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 25 \text{ A}; V_{DS} = 50 \text{ V}; \text{Fig. 12}; \text{Fig. 13}$	-	4.8	-	V
$C_{iss}$	input capacitance	$V_{DS} = 50 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}; \text{Fig. 14}$	-	3181	-	pF
$C_{oss}$	output capacitance		-	551	-	pF
$C_{rss}$	reverse transfer capacitance		-	12	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 50 \text{ V}; R_L = 2 \text{ } \Omega; V_{GS} = 10 \text{ V}; R_{G(ext)} = 5 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$	-	16.8	-	ns
$t_r$	rise time		-	26.8	-	ns

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{d(off)}$	turn-off delay time		-	31.5	-	ns
$t_f$	fall time		-	23.6	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 25\text{ A}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ °C}$ ; Fig. 15	-	0.83	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 25\text{ A}$ ; $di_S/dt = -100\text{ A}/\mu\text{s}$ ; $V_{GS} = 0\text{ V}$ ;	-	51	-	ns
$Q_r$	recovered charge	$V_{DS} = 50\text{ V}$ ; Fig. 16	-	70	-	nC

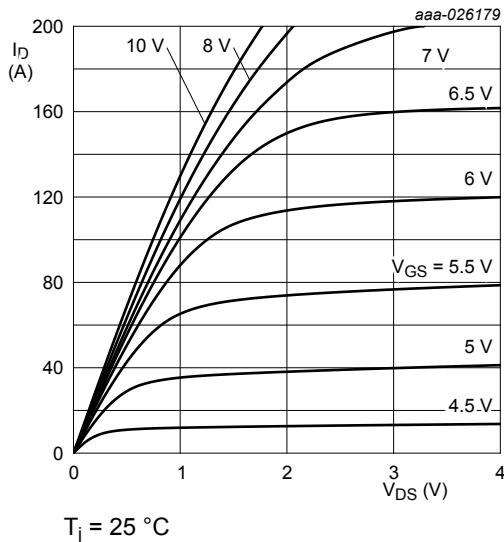


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

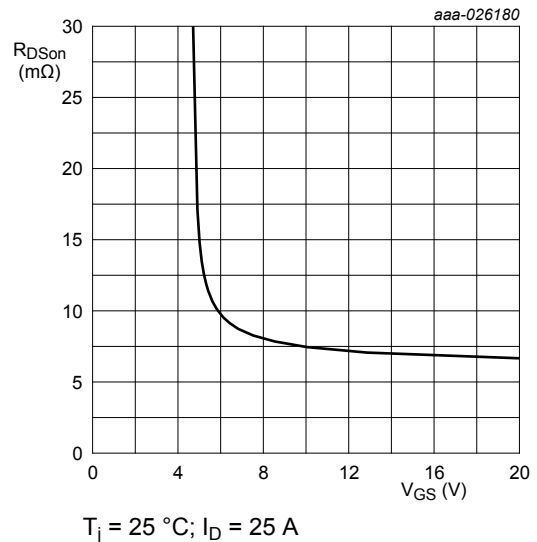


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

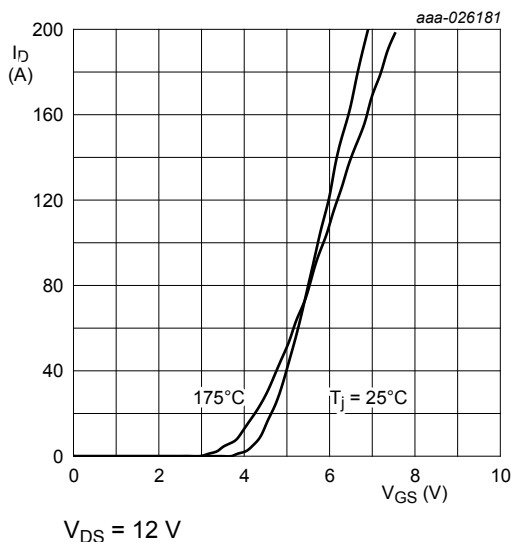


Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values

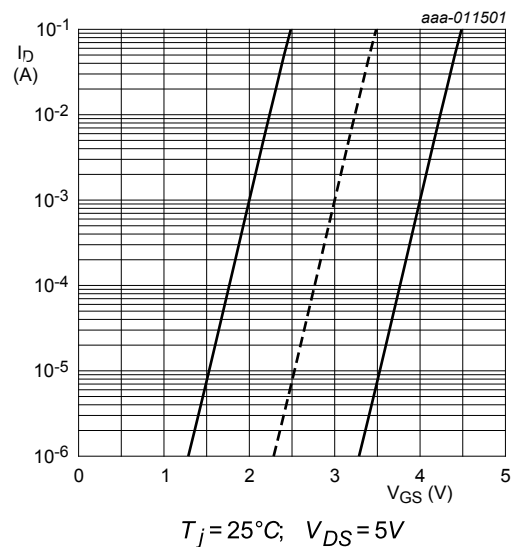


Fig. 9. Sub-threshold drain current as a function of gate-source voltage

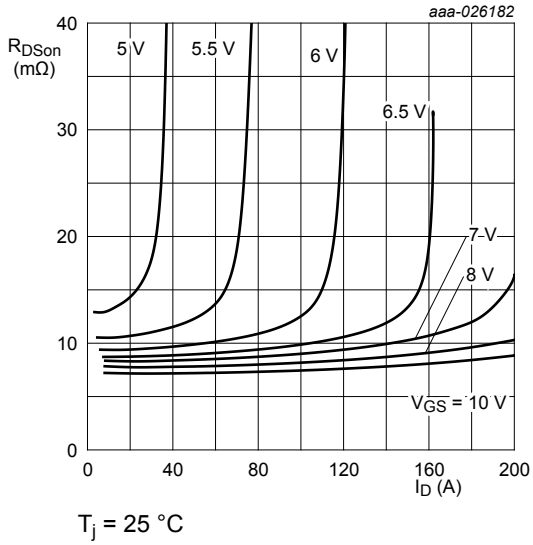
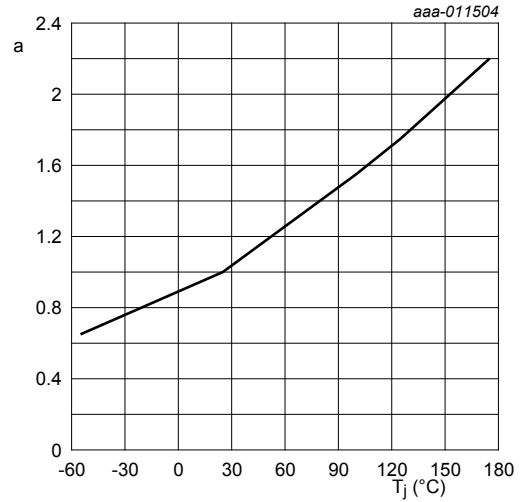


Fig. 10. Drain-source on-state resistance as a function of drain current; typical values



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

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

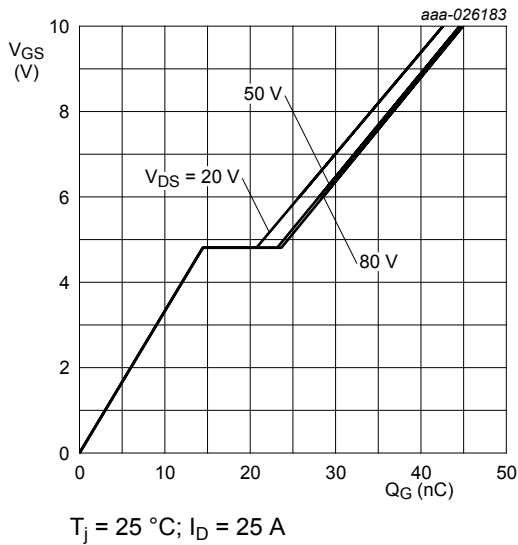


Fig. 12. Gate-source voltage as a function of gate charge; typical values

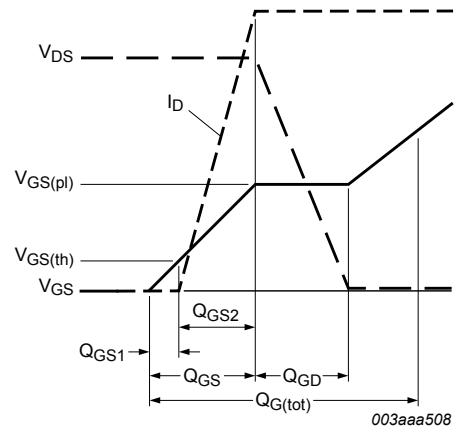


Fig. 13. Gate charge waveform definitions



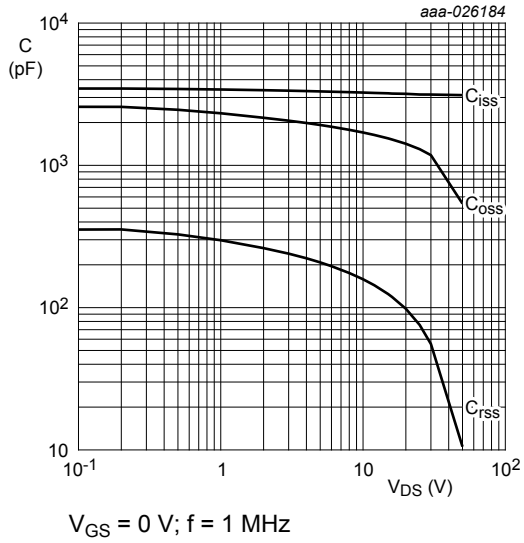


Fig. 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

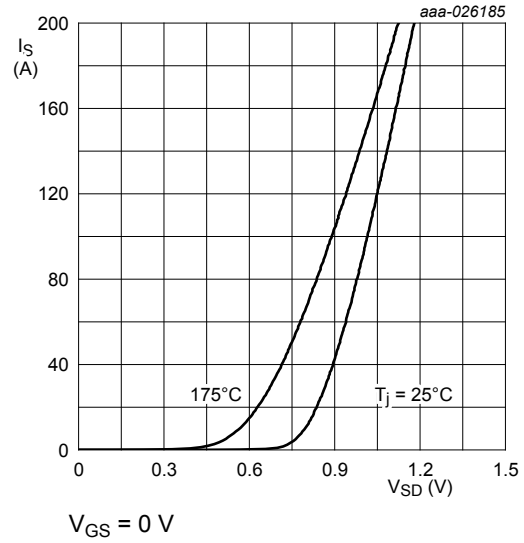


Fig. 15. Source-drain (diode forward) current as a function of source-drain (diode forward) voltage; typical values

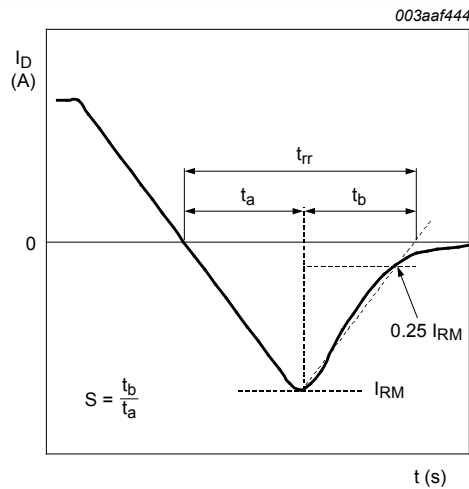


Fig. 16. Reverse recovery timing definition

### 11. Package outline

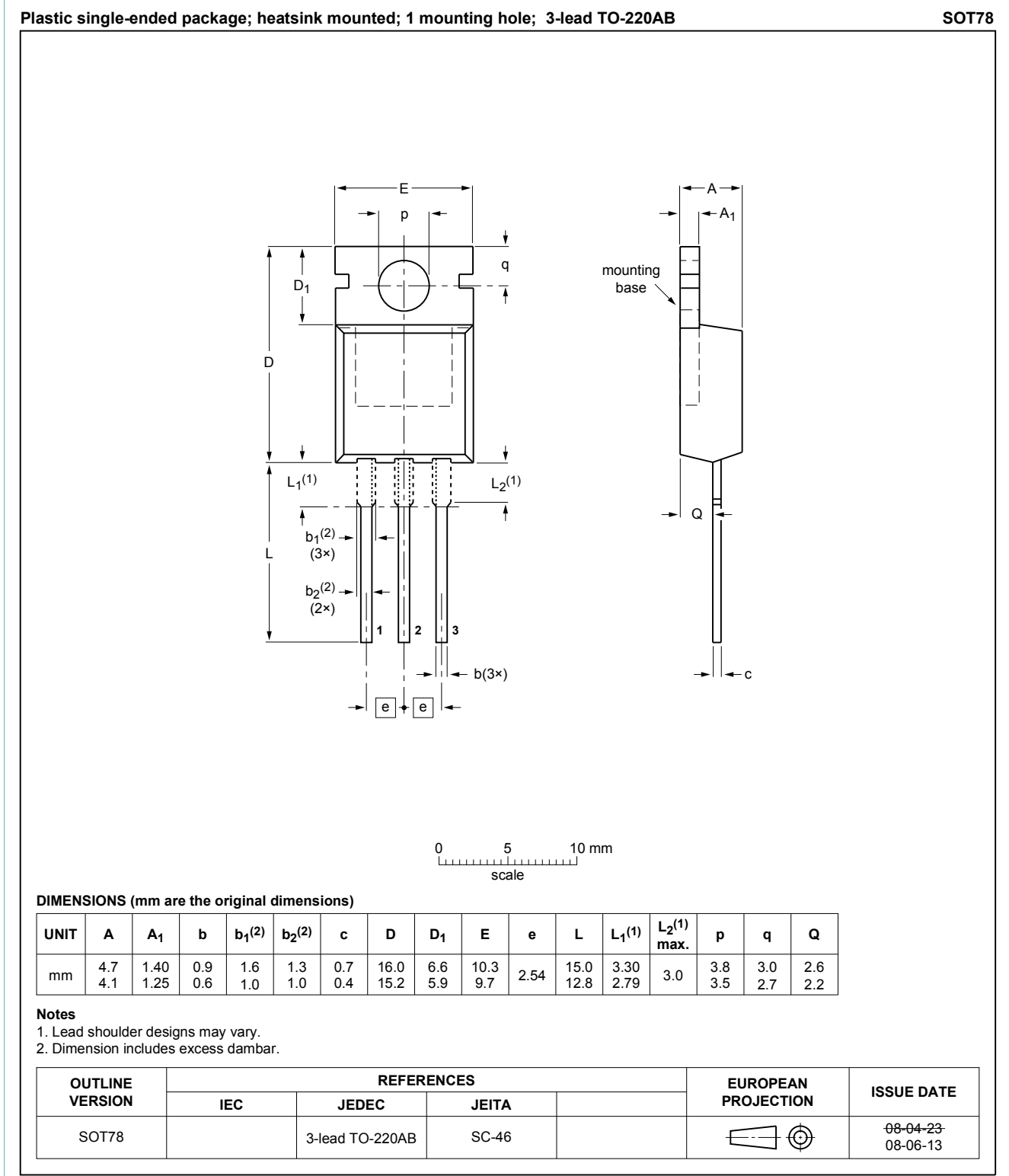


Fig. 17. Package outline TO-220AB (SOT78)

## 12. Legal information

### 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.
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