



# PSMN7R8-120PS

N-channel 120V 7.9mΩ standard level MOSFET in TO220

25 January 2013

Product data sheet

## 1. General description

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

## 2. Features and benefits

- High efficiency due to low switching and conduction losses
- TO220 package
- Suitable for standard level gate drive

## 3. Applications

- AC-to-DC power supply
- Synchronous rectification
- Motor control

## 4. Quick reference data

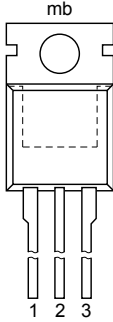
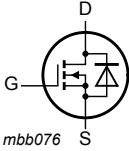
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	120	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V}; \text{Fig. 1}$	-	-	70	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}; \text{Fig. 2}$	-	-	349	W
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ °C}; \text{Fig. 12}$	4.7	6.72	7.9	mΩ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; V_{DS} = 60\text{ V}; \text{Fig. 14}; \text{Fig. 15}$	-	50.5	-	nC
$Q_{G(tot)}$	total gate charge		-	167	-	nC
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(init)} = 25\text{ °C}; I_D = 70\text{ A}; V_{sup} \leq 120\text{ V}; \text{unclamped}; R_{GS} = 50\text{ } \Omega; \text{Fig. 3}$	-	-	386	mJ

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## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p>TO-220AB (SOT78)</p>	 <p>mbb076</p>
2	D	drain		
3	S	source		
mb	D	drain		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN7R8-120PS	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
PSMN7R8-120PS	PSMN7R8-120PS

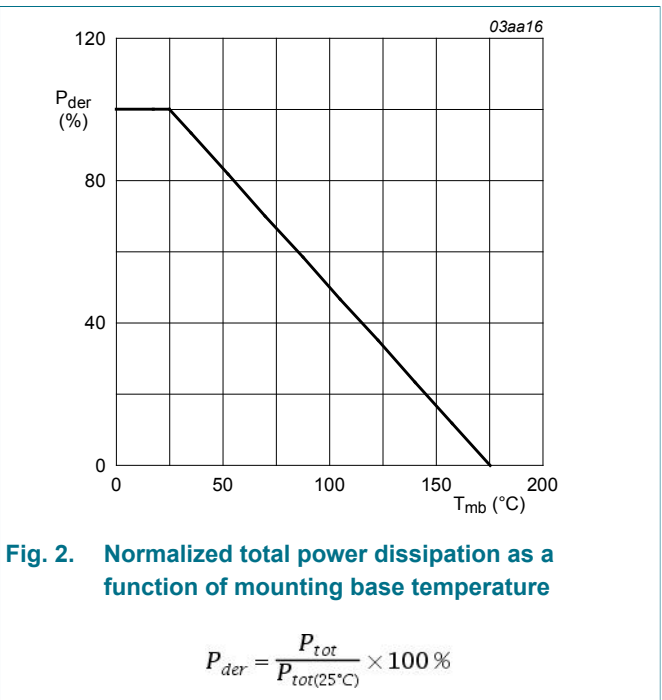
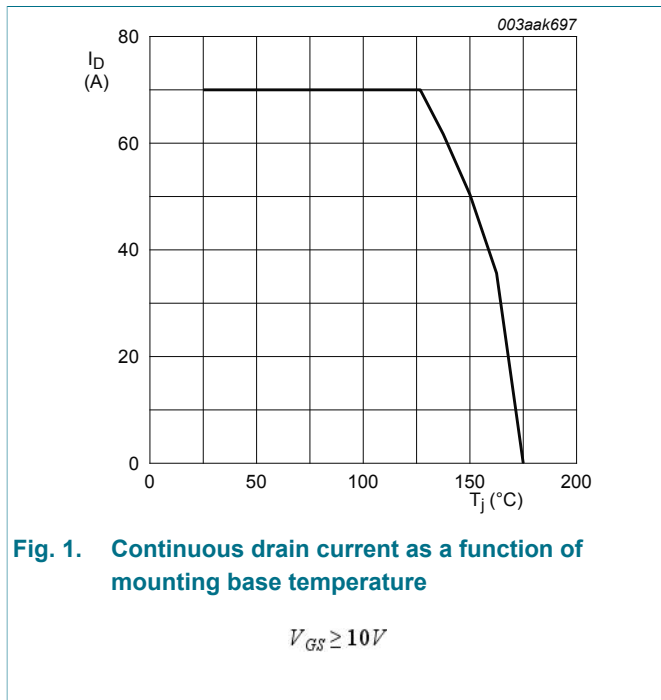
## 8. Limiting values

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	$T_j \geq 25\text{ }^\circ\text{C}$ ; $T_j \leq 175\text{ }^\circ\text{C}$	-	120	V
$V_{DGR}$	drain-gate voltage	$T_j \geq 25\text{ }^\circ\text{C}$ ; $T_j \leq 175\text{ }^\circ\text{C}$ ; $R_{GS} = 20\text{ k}\Omega$	-	120	V
$V_{GS}$	gate-source voltage		-20	20	V
$I_D$	drain current	$V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ }^\circ\text{C}$ ; Fig. 1	-	70	A
		$V_{GS} = 10\text{ V}$ ; $T_{mb} = 100\text{ }^\circ\text{C}$ ; Fig. 1	-	70	A
$I_{DM}$	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ }^\circ\text{C}$ ; Fig. 4	-	280	A

Symbol	Parameter	Conditions	Min	Max	Unit
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 2</a>	-	349	W
$T_{stg}$	storage temperature		-55	175	°C
$T_j$	junction temperature		-55	175	°C
$T_{sl(M)}$	peak soldering temperature		-	260	°C
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25\text{ °C}$	-	70	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$	-	280	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$ ; $T_{j(\text{init})} = 25\text{ °C}$ ; $I_D = 70\text{ A}$ ; $V_{sup} \leq 120\text{ V}$ ; unclamped; $R_{GS} = 50\text{ }\Omega$ ; <a href="#">Fig. 3</a>	-	386	mJ



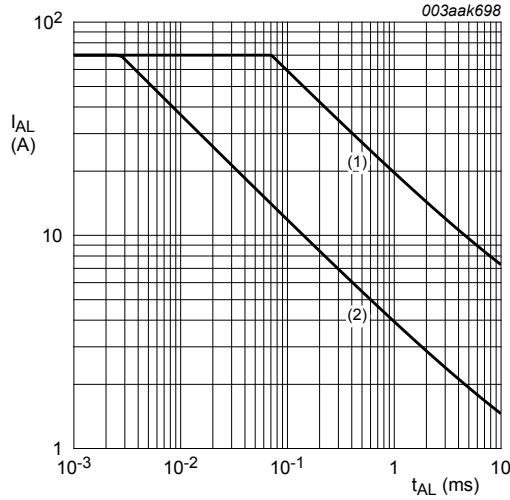


Fig. 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time

- (1) Single-pulse;  $T_j = 25^\circ\text{C}$ .
- (2) Single-pulse;  $T_j = 125^\circ\text{C}$ .

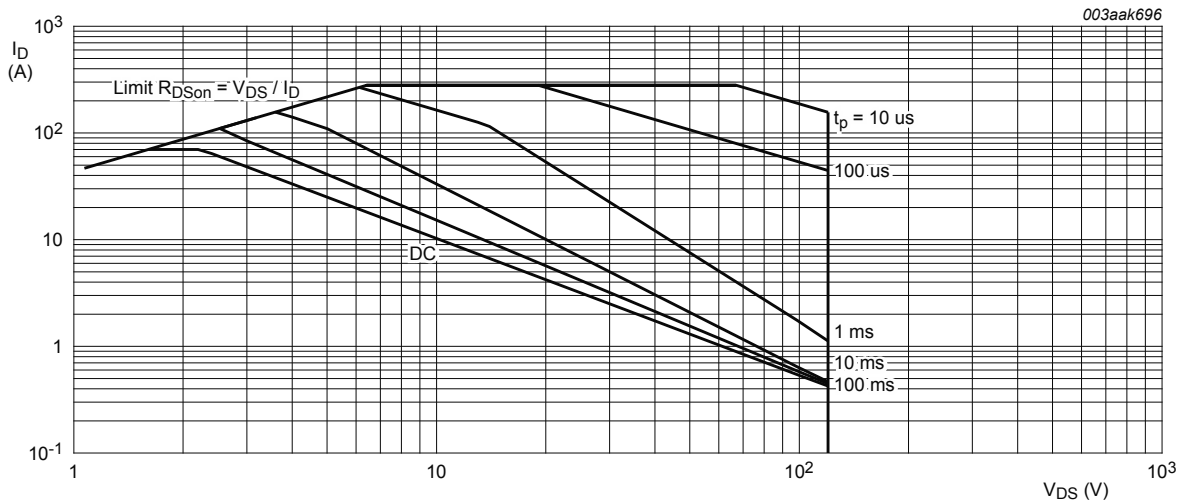


Fig. 4. Safe operating area; continuous and peak drain current as a function of drain-source voltage

$T_{mb} = 25^\circ\text{C}$ ;  $I_{DM}$  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. 5	-	0.35	0.43	K/W

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in free air	-	60	-	K/W

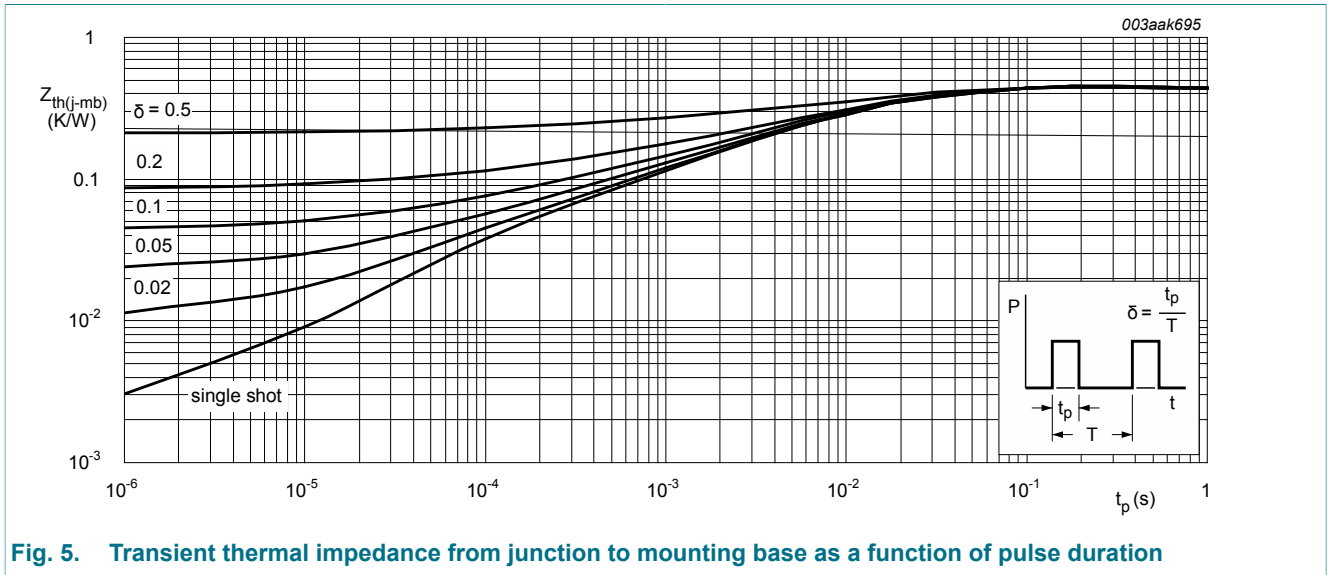


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	120	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	108	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C;$ <a href="#">Fig. 10; Fig. 11</a>	2	3	4	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ C;$ <a href="#">Fig. 10</a>	1	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C;$ <a href="#">Fig. 10</a>	-	-	4.6	V
$I_{DSS}$	drain leakage current	$V_{DS} = 120 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	0.1	1	$\mu A$
		$V_{DS} = 120 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ C$	-	-	500	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	10	100	nA
		$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	10	100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ C;$ <a href="#">Fig. 12</a>	4.7	6.72	7.9	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ C;$ <a href="#">Fig. 12; Fig. 13</a>	-	19.3	22.9	mΩ

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_G$	internal gate resistance (AC)	$f = 1 \text{ MHz}$	0.39	0.78	1.56	$\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(\text{tot})}$	total gate charge	$I_D = 25 \text{ A}; V_{DS} = 60 \text{ V}; V_{GS} = 10 \text{ V};$ <a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a>	-	167	-	nC
$Q_{GS}$	gate-source charge		-	36.9	-	nC
$Q_{GS(\text{th})}$	pre-threshold gate-source charge		-	24.2	-	nC
$Q_{GS(\text{th-pl})}$	post-threshold gate-source charge		-	12.7	-	nC
$Q_{GD}$	gate-drain charge		-	50.5	-	nC
$V_{GS(\text{pl})}$	gate-source plateau voltage	$I_D = 25 \text{ A}; V_{DS} = 60 \text{ V};$ <a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a>	-	4.5	-	V
$C_{iss}$	input capacitance	$V_{DS} = 60 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C};$ <a href="#">Fig. 16</a>	-	9473	-	pF
$C_{oss}$	output capacitance		-	441	-	pF
$C_{rss}$	reverse transfer capacitance		-	298	-	pF
$t_{d(\text{on})}$	turn-on delay time	$V_{DS} = 60 \text{ V}; R_L = 2.4 \text{ } \Omega; V_{GS} = 10 \text{ V};$ $R_{G(\text{ext})} = 5 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$	-	45.5	-	ns
$t_r$	rise time		-	55.3	-	ns
$t_{d(\text{off})}$	turn-off delay time		-	151.8	-	ns
$t_f$	fall time		-	60.8	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 25 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C};$ <a href="#">Fig. 17</a>	-	0.81	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 25 \text{ A}; di_S/dt = -100 \text{ A}/\mu\text{s}; V_{GS} = 0 \text{ V};$ $V_{DS} = 60 \text{ V}$	-	75.7	-	ns
$Q_r$	recovered charge		-	264	-	nC

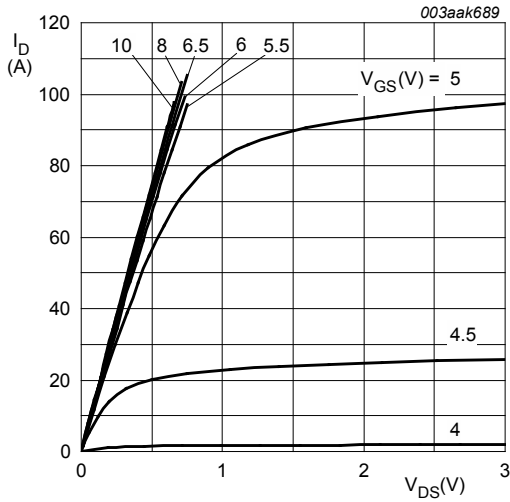


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

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

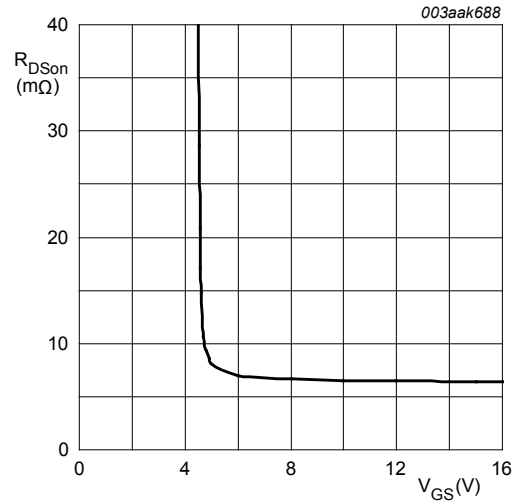


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

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

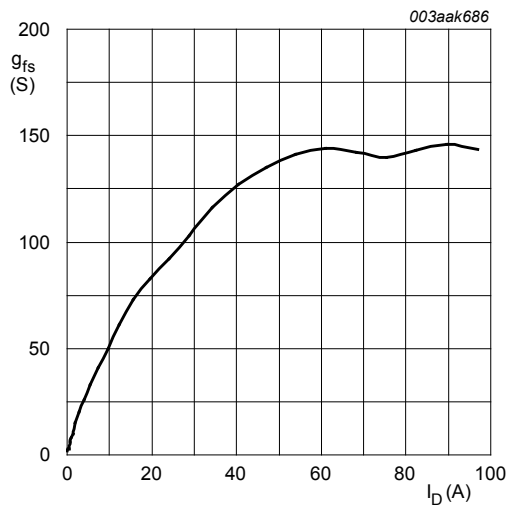


Fig. 8. Forward transconductance as a function of drain current; typical values

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

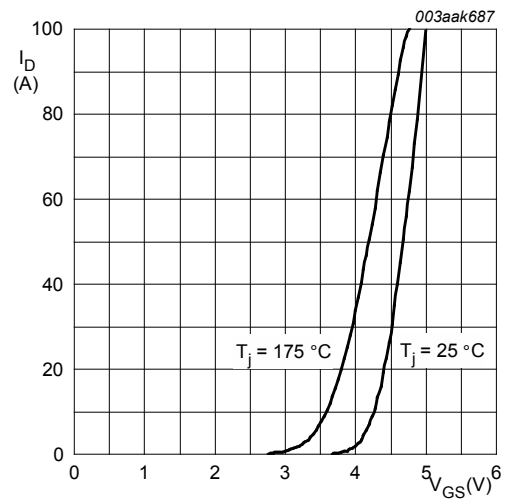
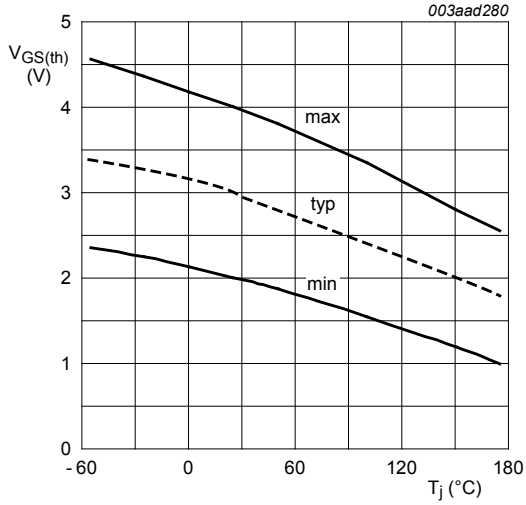


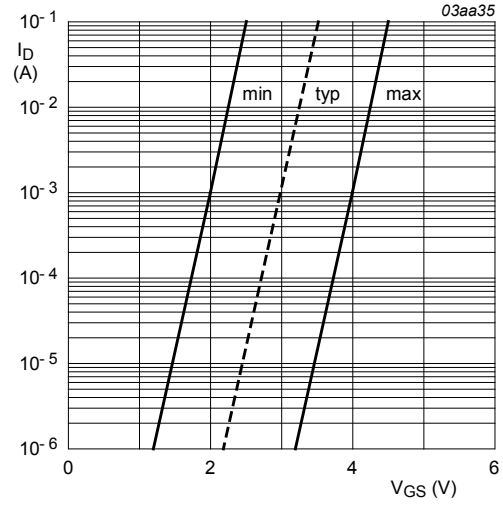
Fig. 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values

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



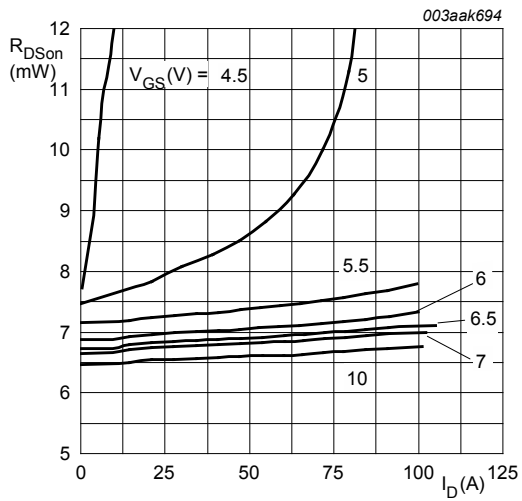
**Fig. 10. Gate-source threshold voltage as a function of junction temperature**

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



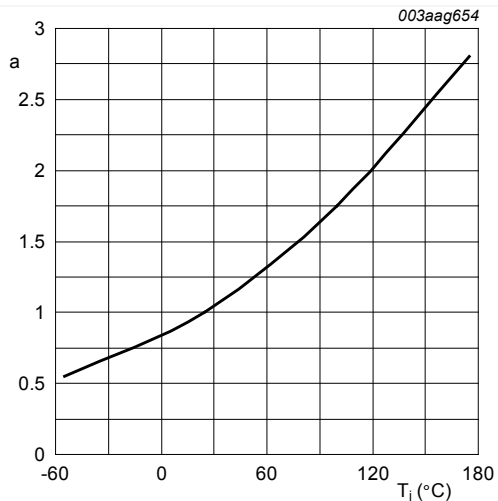
**Fig. 11. Sub-threshold drain current as a function of gate-source voltage**

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



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

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



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

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



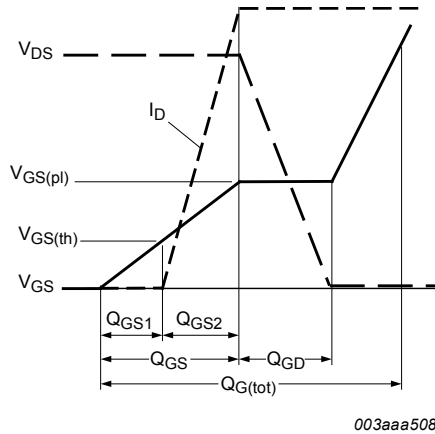


Fig. 14. Gate charge waveform definitions

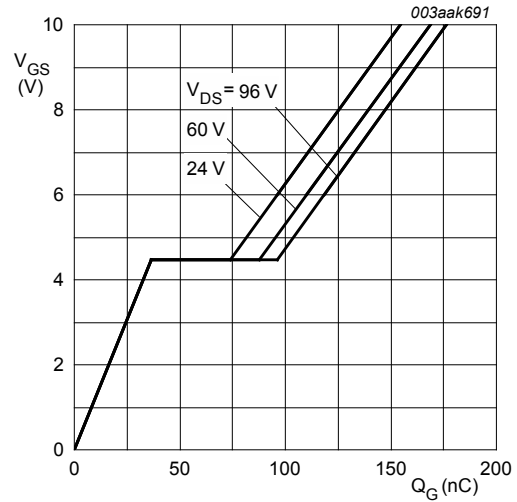


Fig. 15. Gate-source voltage as a function of gate charge; typical values

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

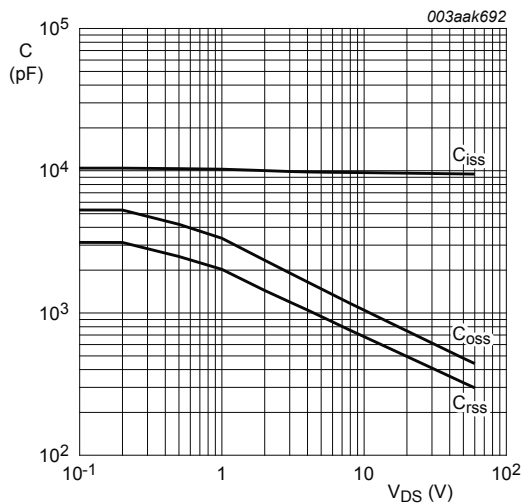


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

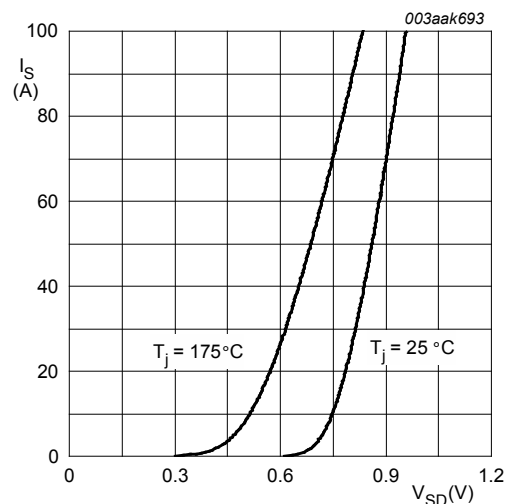


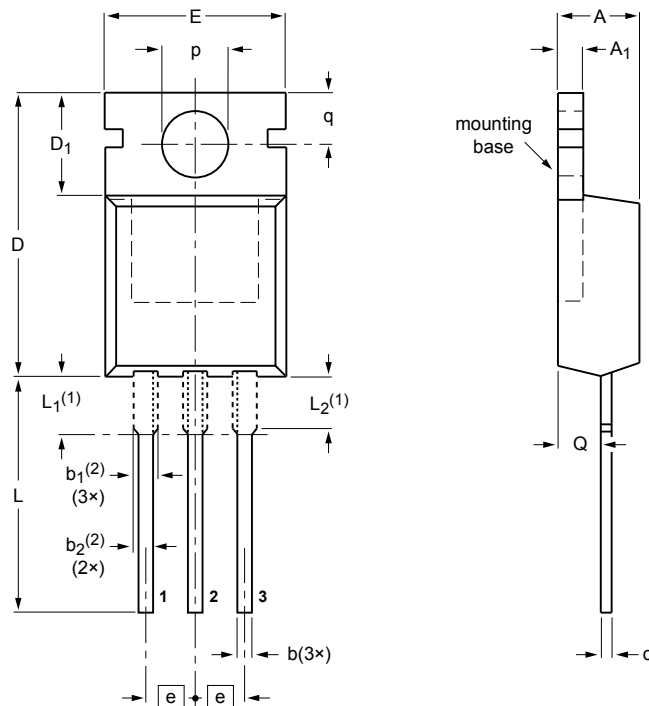
Fig. 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

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

### 11. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB

SOT78



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	b	b <sub>1</sub> (2)	b <sub>2</sub> (2)	c	D	D <sub>1</sub>	E	e	L	L <sub>1</sub> (1)	L <sub>2</sub> (1) max.	p	q	Q
mm	4.7 4.1	1.40 1.25	0.9 0.6	1.6 1.0	1.3 1.0	0.7 0.4	16.0 15.2	6.6 5.9	10.3 9.7	2.54	15.0 12.8	3.30 2.79	3.0	3.8 3.5	3.0 2.7	2.6 2.2

**Notes**

- 1. Lead shoulder designs may vary.
- 2. Dimension includes excess dambar.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA		
SOT78		3-lead TO-220AB	SC-46		08-04-23 08-06-13

Fig. 18. Package outline TO-220AB (SOT78)

## 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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