



PSMN4R8-100PSE

N-channel 100 V 5 mΩ standard level MOSFET with improved SOA in TO220 package

11 July 2014

Product data sheet

1. General description

Standard level N-channel MOSFET with improved SOA in a TO220 package. Part of Nexpria "NextPower Live" portfolio, the PSMN4R8-100PSE is robust enough to withstand substantial in-rush and fault condition currents during turn on/off, whilst offering a low $R_{DS(on)}$ characteristic to keep temperatures down and efficiency up in continued use. Ideal for telecommunication systems based on 48 V backplanes / supply rails.

2. Features and benefits

- Enhanced safe operating area (SOA) for superior protection during linear mode operation
- Very low $R_{DS(on)}$ for low conduction losses

3. Applications

- Electronic fuse
- Hot-swap / Soft-start
- Uninterruptible power supplies
- Motor control

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25^\circ\text{C}$; $T_j \leq 175^\circ\text{C}$	-	-	100	V
I_{DM}	peak drain current	pulsed; $T_{mb} = 25^\circ\text{C}$; $t_p \leq 10 \mu\text{s}$; Fig. 3	-	-	693	A
P_{tot}	total power dissipation	$T_{mb} = 25^\circ\text{C}$; Fig. 1	-	-	405	W
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10 \text{ V}$; $I_D = 25 \text{ A}$; $T_j = 25^\circ\text{C}$; Fig. 12	-	4.3	5	$\text{m}\Omega$
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 10 \text{ V}$; $I_D = 25 \text{ A}$; $V_{DS} = 50 \text{ V}$; Fig. 14 ; Fig. 15	-	59	83	nC
$Q_{G(tot)}$	total gate charge		-	196	278	nC

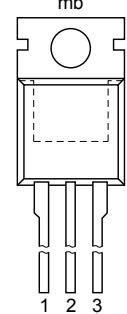
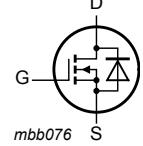
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Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10$ V; $T_{j(init)} = 25$ °C; $I_D = 120$ A; $V_{sup} \leq 100$ V; $R_{GS} = 50$ Ω; unclamped; Fig. 4		-	-	542	mJ

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		
	Name	Description	Version
PSMN4R8-100PSE	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
PSMN4R8-100PSE	PSMN4R8-100PSE

8. Limiting values

Table 5. Limiting values

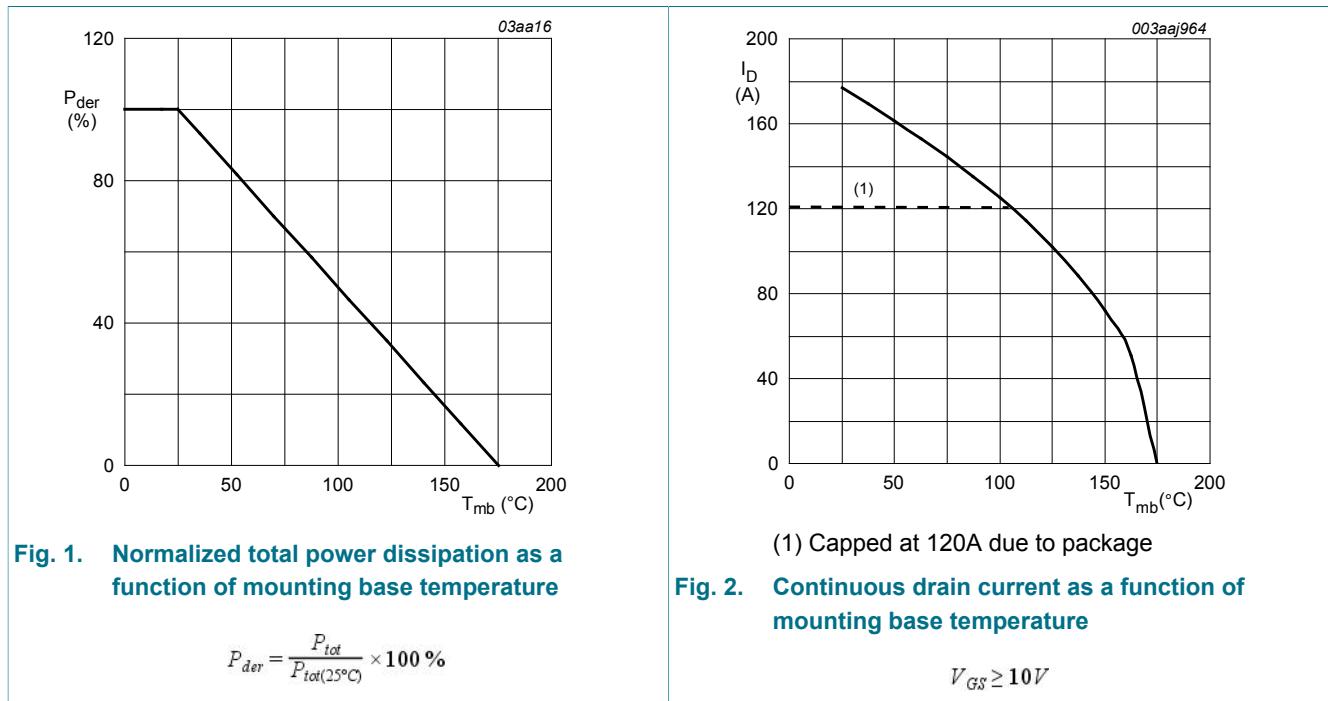
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	100	V

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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
P_{tot}	total power dissipation	$T_{mb} = 25^\circ\text{C}$; Fig. 1		-	405	W
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_j = 25^\circ\text{C}$; Fig. 2	[1]	-	120	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 100^\circ\text{C}$; Fig. 2	[1]	-	120	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25^\circ\text{C}$; Fig. 3		-	693	A
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	$T_{mb} = 25^\circ\text{C}$	[1]	-	120	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25^\circ\text{C}$		-	693	A
Avalanche ruggedness						
$E_{DS(ALS)}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25^\circ\text{C}$; $I_D = 120\text{ A}$; $V_{sup} \leq 100\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped; Fig. 4		-	542	mJ

[1] Continuous current limited by package.



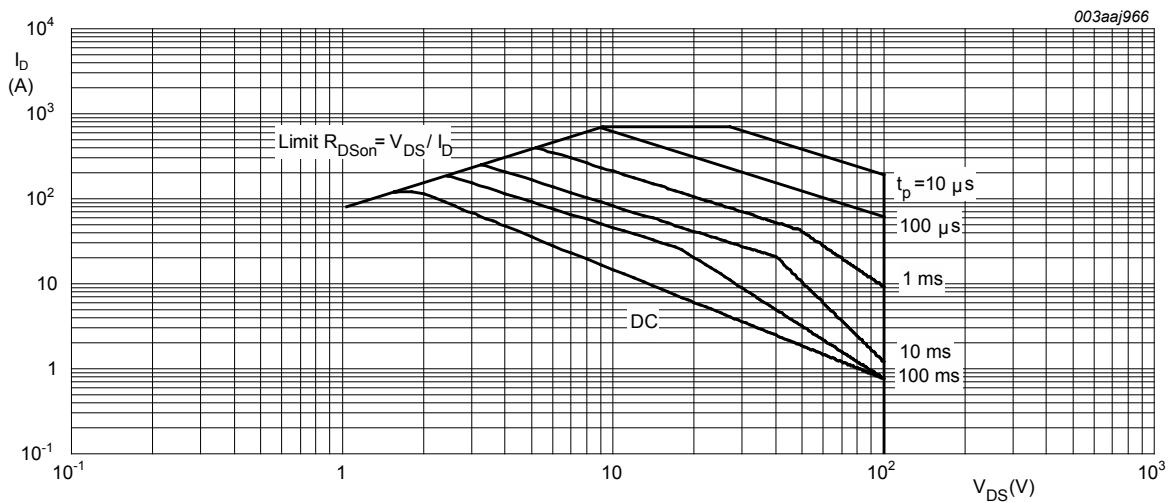


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25^\circ\text{C}$; I_{DM} is a single pulse; Capped at 120 A due to package

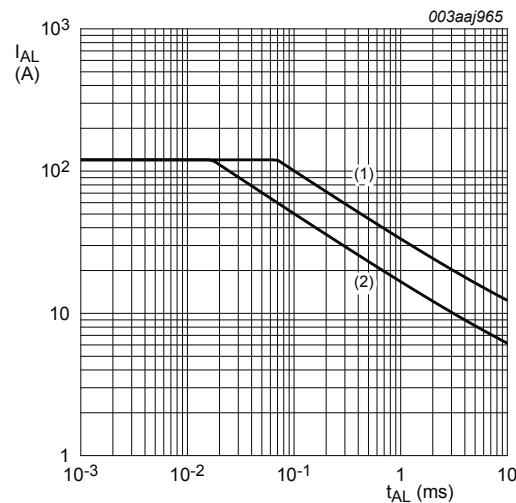


Fig. 4. Single pulse avalanche rating; avalanche current as a function of avalanche time

(1) $T_j \text{ (int)} = 25^\circ\text{C}$; (2) $T_j \text{ (int)} = 100^\circ\text{C}$

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	-	0.3	0.37	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	Minimum footprint; mounted on a printed circuit board	-	60	-	K/W

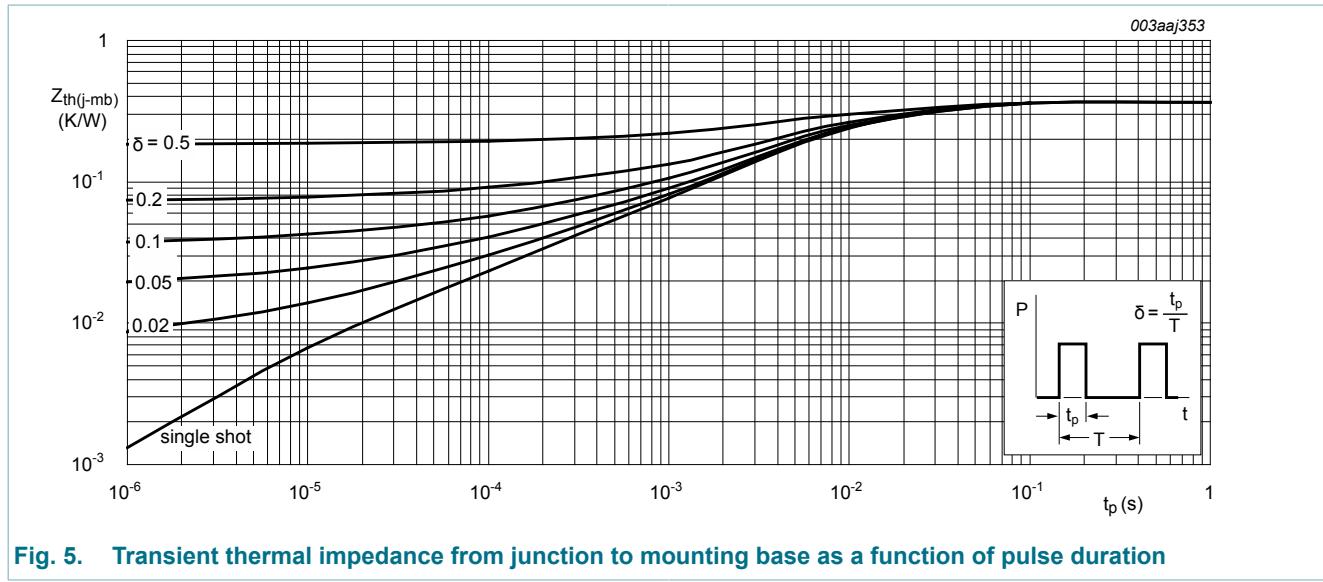


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25^\circ C$		100	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55^\circ C$		90	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25^\circ C$ Fig. 10 ; Fig. 11	2	3	4	4.6	V
V_{GSth}	gate-source threshold voltage	$I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175^\circ C$ Fig. 11	1	-	-	-	V
		$I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55^\circ C$ Fig. 11		-	-	4.6	V
I_{DSS}	drain leakage current	$V_{DS} = 100 V; V_{GS} = 0 V; T_j = 25^\circ C$		-	0.16	10	μA
		$V_{DS} = 100 V; V_{GS} = 0 V; T_j = 175^\circ C$		-	-	500	μA
I_{GSS}	gate leakage current	$V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25^\circ C$		-	10	100	nA
		$V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25^\circ C$		-	10	100	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10 V; I_D = 25 A; T_j = 25^\circ C$ Fig. 12		-	4.3	5	$m\Omega$
		$V_{GS} = 10 V; I_D = 25 A; T_j = 100^\circ C$ Fig. 13 ; Fig. 12		-	-	9	$m\Omega$
		$V_{GS} = 10 V; I_D = 25 A; T_j = 175^\circ C$ Fig. 12 ; Fig. 13		-	-	13.5	$m\Omega$
R_G	gate resistance	$f = 1 MHz$		0.43	0.85	1.7	Ω

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Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Dynamic characteristics							
$Q_{G(\text{tot})}$	total gate charge	$I_D = 25 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V};$ Fig. 14 ; Fig. 15		-	196	278	nC
		$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$		-	166.9	234	nC
Q_{GS}	gate-source charge	$I_D = 25 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V};$ Fig. 14 ; Fig. 15		-	40	56	nC
	gate-drain charge			-	59	83	nC
$V_{GS(\text{pl})}$	gate-source plateau voltage	$I_D = 25 \text{ A}; V_{DS} = 50 \text{ V};$ Fig. 14 ; Fig. 15		-	4.3	-	V
C_{iss}	input capacitance	$V_{DS} = 50 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C}$; Fig. 16		-	10665	14400	pF
C_{oss}	output capacitance			-	674	910	pF
C_{rss}	reverse transfer capacitance			-	459	643	pF
$t_{d(\text{on})}$	turn-on delay time	$V_{DS} = 50 \text{ V}; R_L = 2 \Omega; V_{GS} = 10 \text{ V};$ $R_{G(\text{ext})} = 4.7 \Omega$		-	41	61.5	ns
t_r	rise time			-	65	97.5	ns
$t_{d(\text{off})}$	turn-off delay time			-	127	190.5	ns
t_f	fall time			-	69	103.5	ns
Source-drain diode							
V_{SD}	source-drain voltage	$I_S = 25 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$; Fig. 17		-	0.79	1.2	V
t_{rr}	reverse recovery time	$I_S = 25 \text{ A}; dI_S/dt = -100 \text{ A}/\mu\text{s}; V_{GS} = 0 \text{ V};$ $V_{DS} = 50 \text{ V}$		-	72	94	ns
Q_r	recovered charge			-	227	296	nC

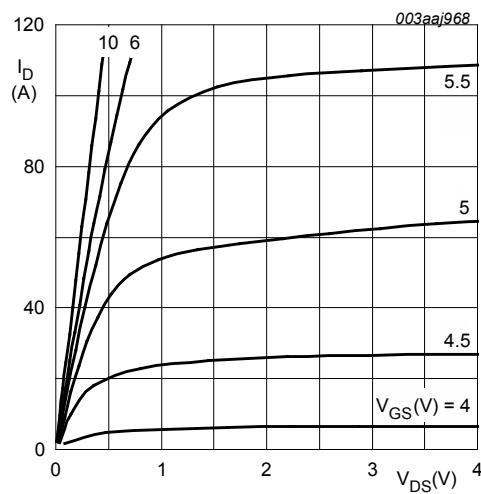


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

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

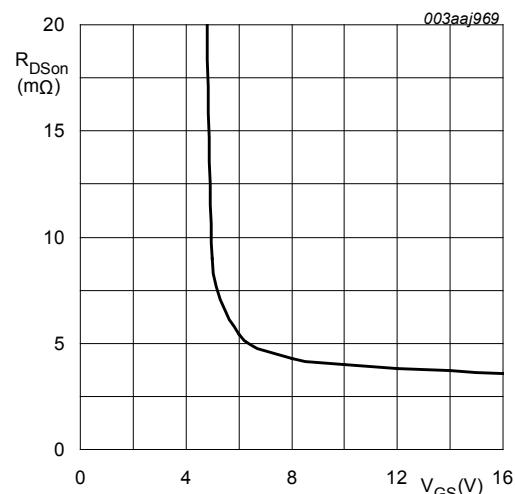


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

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

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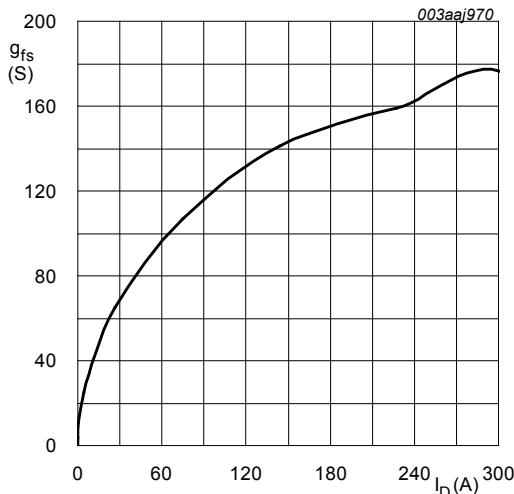


Fig. 8. Forward transconductance as a function of drain current; typical values

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

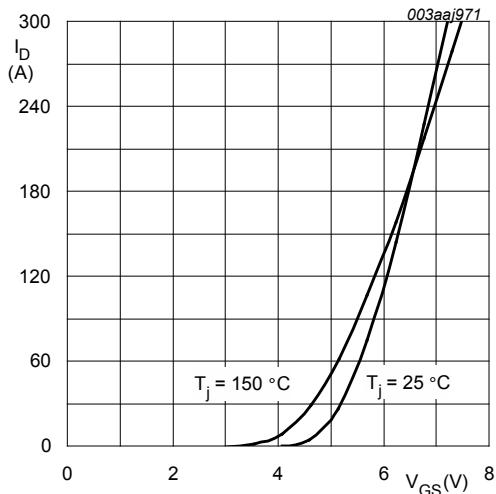


Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

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

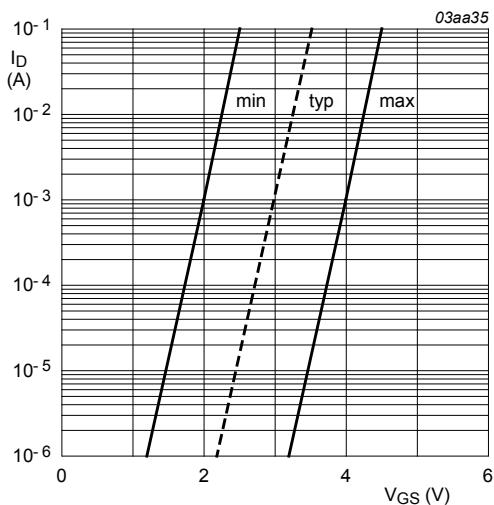


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

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

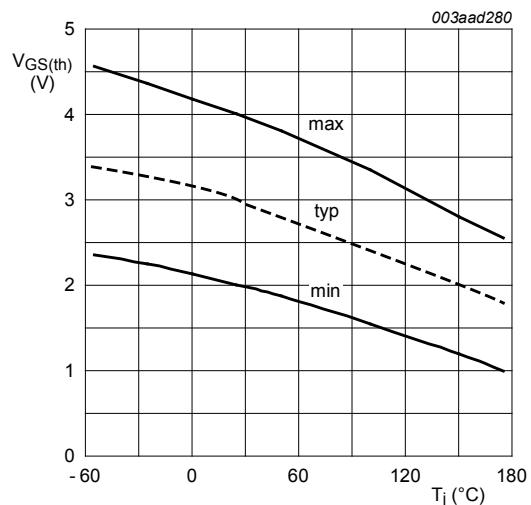


Fig. 11. Gate-source threshold voltage as a function of junction temperature

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

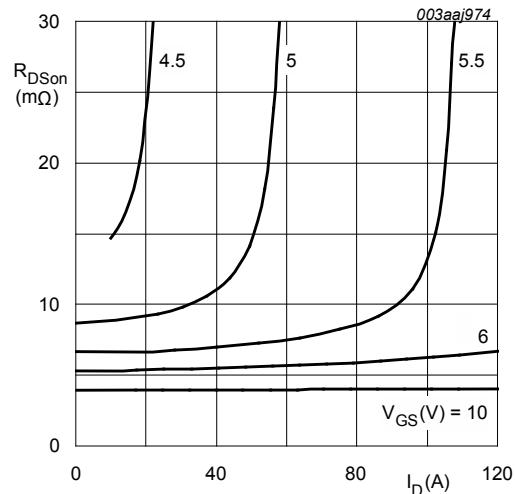


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

$T_j = 25^\circ C$

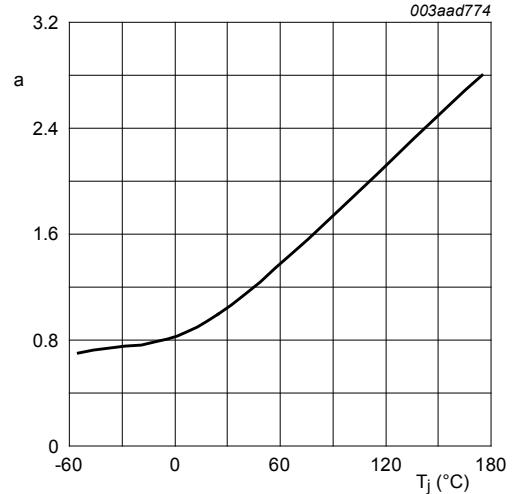


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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

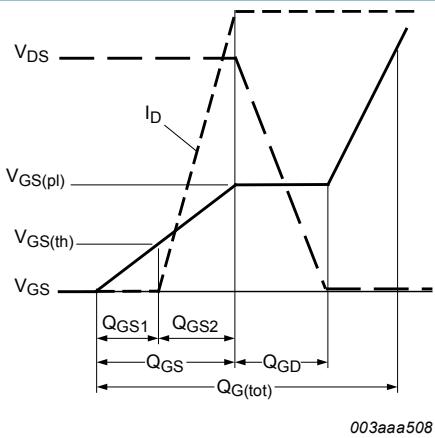


Fig. 14. Gate charge waveform definitions

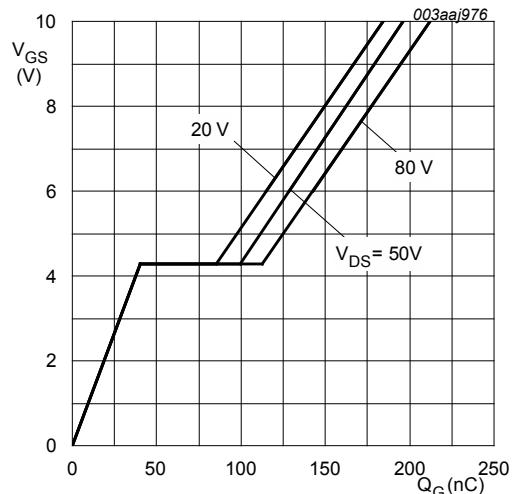


Fig. 15. Gate-source voltage as a function of gate charge; typical values

$T_j = 25^\circ C; I_D = 25A$

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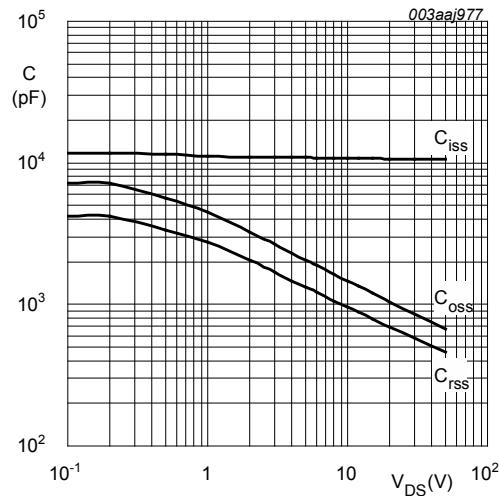


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

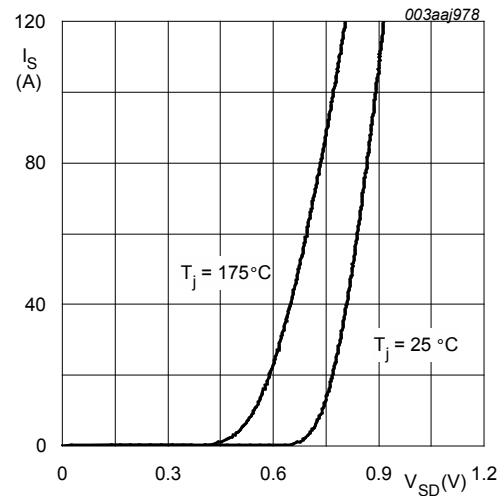


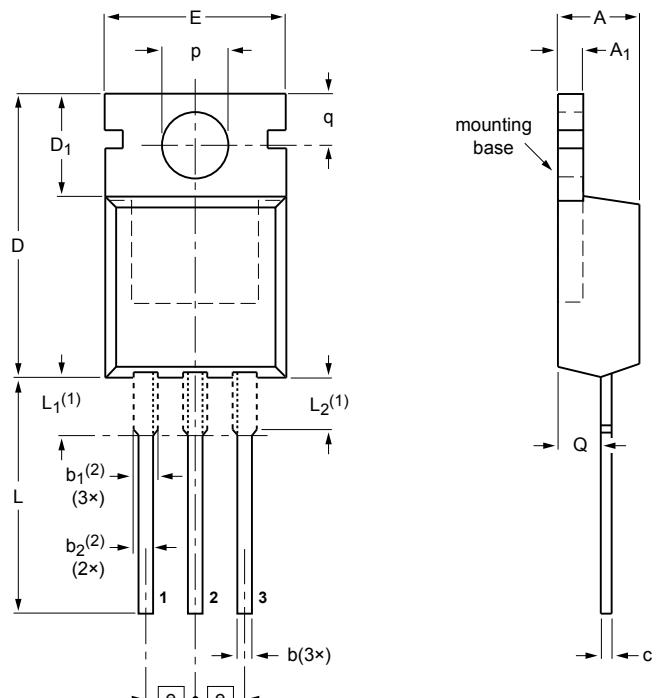
Fig. 17. Source current as a function of source-drain voltage; typical values

$V_{GS} = 0V$

11. Package outline

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

SOT78



0 5 10 mm
scale

DIMENSIONS (mm are the original dimensions)

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

12.1 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.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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