



PSMN2R2-40PS

N-channel 40 V 2.1 mΩ standard level MOSFET

22 February 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 domestic equipment.

2. Features and benefits

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

3. Applications

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

4. Quick reference data

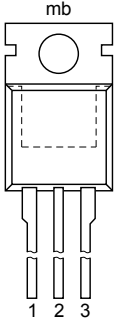
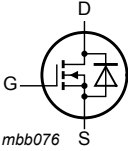
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$		-	-	40	V
I_D	drain current	$T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; Fig. 3 ; Fig. 1		-	-	100	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Fig. 2		-	-	306	W
Static characteristics							
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; Fig. 12	[1]	-	1.75	2.1	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	$V_{GS} = 10\text{ V}$; $I_D = 80\text{ A}$; $V_{DS} = 20\text{ V}$; Fig. 14 ; Fig. 15		-	25	-	nC

[1] Measured 3 mm from package.

5. Pinning information

Table 2. Pinning information

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

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN2R2-40PS	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
PSMN2R2-40PS	PSMN2R2-40PS

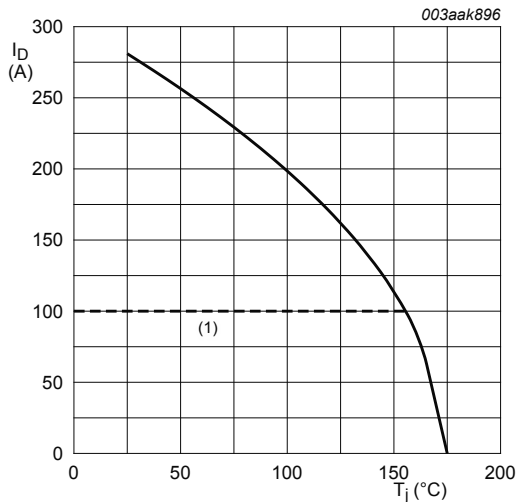
8. Limiting values

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	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	40	V
V_{DGR}	drain-gate voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	40	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ °C}$; Fig. 1	-	100	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; Fig. 3; Fig. 1	-	100	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$; Fig. 3	-	1122	A

Symbol	Parameter	Conditions		Min	Max	Unit
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 2		-	306	W
T _{stg}	storage temperature			-55	175	°C
T _j	junction temperature			-55	175	°C
Source-drain diode						
I _S	source current	T _{mb} = 25 °C		-	100	A
I _{SM}	peak source current	pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C		-	1122	A
Avalanche ruggedness						
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	V _{GS} = 10 V; T _{j(initial)} = 25 °C; I _D = 100 A; V _{sup} ≤ 40 V; unclamped; R _{GS} = 50 Ω		-	1.24	J



(1) Capped at 100 A due to package

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

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

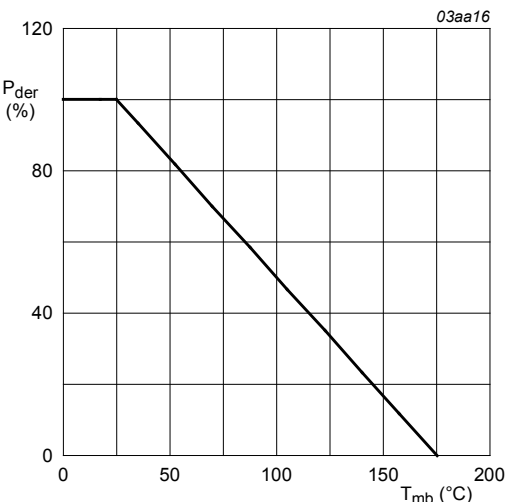


Fig. 2. Normalized total power dissipation as a function of mounting base temperature

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

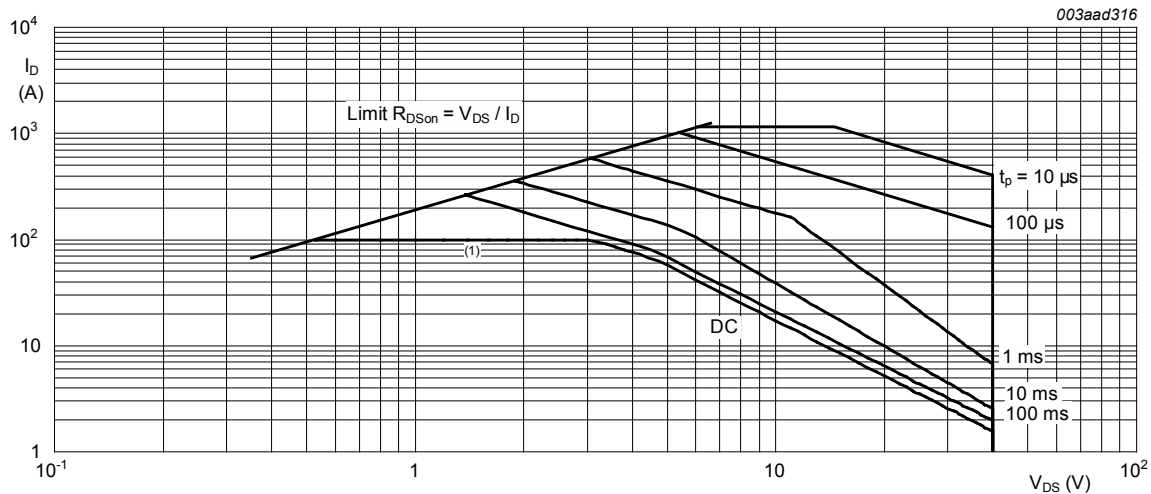


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25\text{ }^{\circ}\text{C}$; I_{DM} is a single pulse; (1) Capped at 100 A due to package

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	-	0.25	0.5	K/W

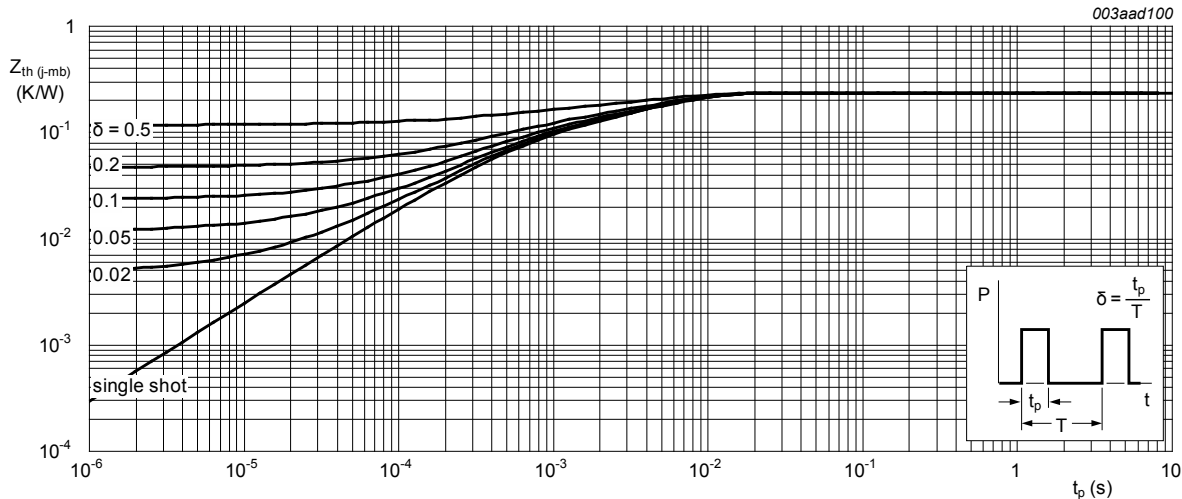


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

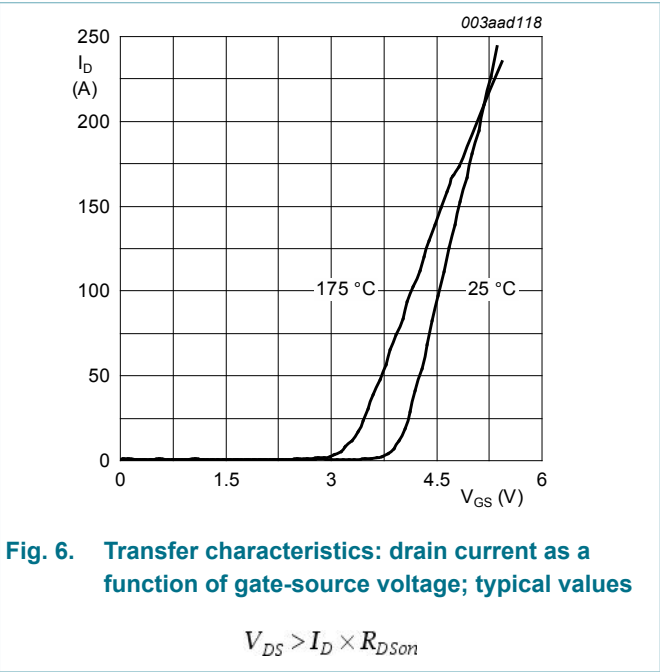
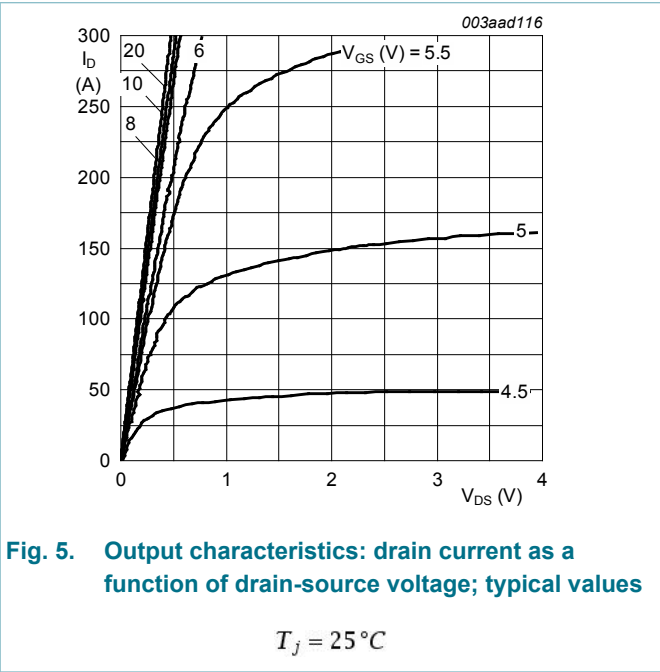
Table 7. Characteristics

Tested to JEDEC standards where applicable.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$; $T_J = -55\ ^\circ\text{C}$		36	-	-	V
		$I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$; $T_J = 25\ ^\circ\text{C}$		40	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_J = -55\ ^\circ\text{C}$; Fig. 10		-	-	4.6	V
		$I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_J = 175\ ^\circ\text{C}$; Fig. 10		1	-	-	V
		$I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_J = 25\ ^\circ\text{C}$; Fig. 11 ; Fig. 10		2	3	4	V
I_{DSS}	drain leakage current	$V_{DS} = 40\ \text{V}$; $V_{GS} = 0\ \text{V}$; $T_J = 25\ ^\circ\text{C}$		-	-	10	μA
		$V_{DS} = 40\ \text{V}$; $V_{GS} = 0\ \text{V}$; $T_J = 125\ ^\circ\text{C}$		-	-	200	μA
I_{GSS}	gate leakage current	$V_{GS} = 20\ \text{V}$; $V_{DS} = 0\ \text{V}$; $T_J = 25\ ^\circ\text{C}$		-	-	100	nA
		$V_{GS} = -20\ \text{V}$; $V_{DS} = 0\ \text{V}$; $T_J = 25\ ^\circ\text{C}$		-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; $T_J = 100\ ^\circ\text{C}$; Fig. 12 ; Fig. 13		-	2.4	2.85	mΩ
		$V_{GS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; $T_J = 175\ ^\circ\text{C}$; Fig. 12 ; Fig. 13		-	3.25	3.9	mΩ
		$V_{GS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; $T_J = 25\ ^\circ\text{C}$; Fig. 12	[1]	-	1.75	2.1	mΩ
R_G	internal gate resistance (AC)	$f = 1\ \text{MHz}$		-	1	-	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	$I_D = 0\ \text{A}$; $V_{DS} = 0\ \text{V}$; $V_{GS} = 10\ \text{V}$		-	110	-	nC
		$I_D = 80\ \text{A}$; $V_{DS} = 20\ \text{V}$; $V_{GS} = 10\ \text{V}$; Fig. 14 ; Fig. 15		-	130	-	nC
Q_{GS}	gate-source charge			-	42	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge			-	24	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge			-	18	-	nC
Q_{GD}	gate-drain charge			-	25	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 80\ \text{A}$; $V_{DS} = 20\ \text{V}$; Fig. 14 ; Fig. 15		-	4.95	-	V
C_{iss}	input capacitance	$V_{DS} = 20\ \text{V}$; $V_{GS} = 0\ \text{V}$; $f = 1\ \text{MHz}$;		-	8423	-	pF
C_{oss}	output capacitance	$T_J = 25\ ^\circ\text{C}$; Fig. 16		-	1671	-	pF

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
C _{rss}	reverse transfer capacitance			-	814	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = 20 V; R _L = 0.25 Ω; V _{GS} = 10 V; R _{G(ext)} = 1.5 Ω		-	33.2	-	ns
t _r	rise time			-	40.4	-	ns
t _{d(off)}	turn-off delay time			-	66.6	-	ns
t _f	fall time			-	25.2	-	ns
Source-drain diode							
V _{SD}	source-drain voltage	I _S = 25 A; V _{GS} = 0 V; T _j = 25 °C; Fig. 17		-	0.85	1.2	V
t _{rr}	reverse recovery time	I _S = 25 A; dI _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 20 V		-	53.7	-	ns
Q _r	recovered charge	I _S = 25 A; dI _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 20 V; T _j = 25 °C		-	80.75	-	nC

[1] Measured 3 mm from package.



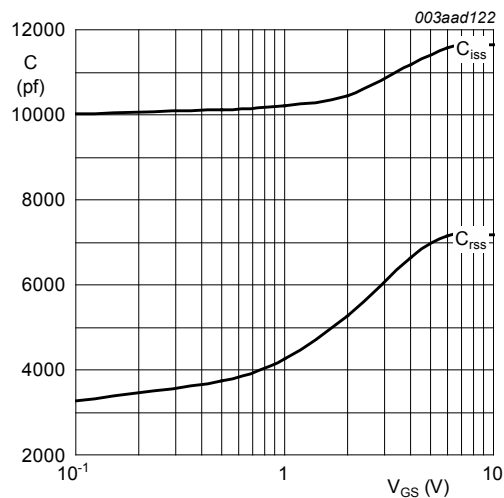


Fig. 7. Input and reverse transfer capacitances as a function of gate-source voltage; typical values

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

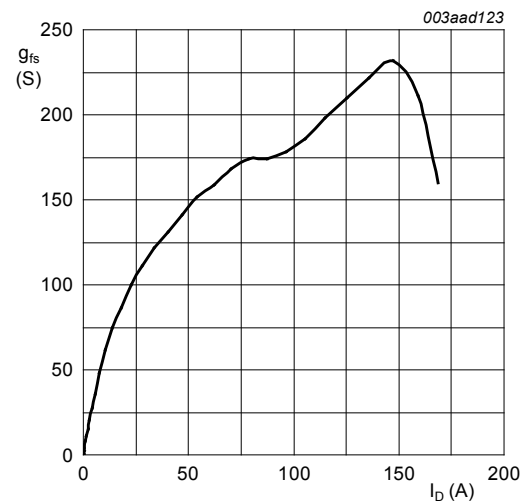


Fig. 8. Forward transconductance as a function of drain current; typical values

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

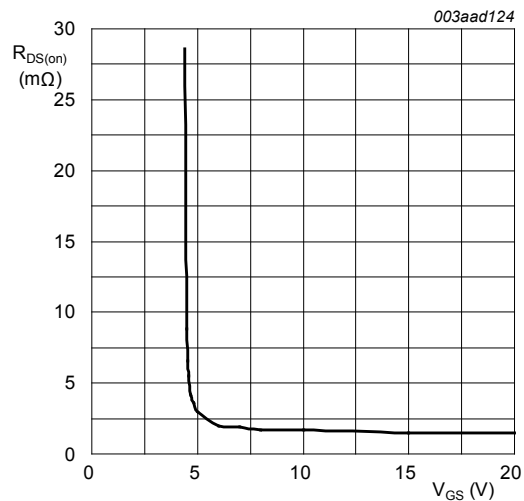


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

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

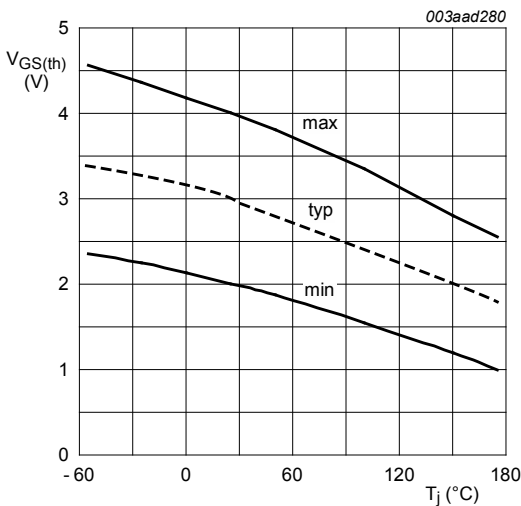


Fig. 10. Gate-source threshold voltage as a function of junction temperature

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

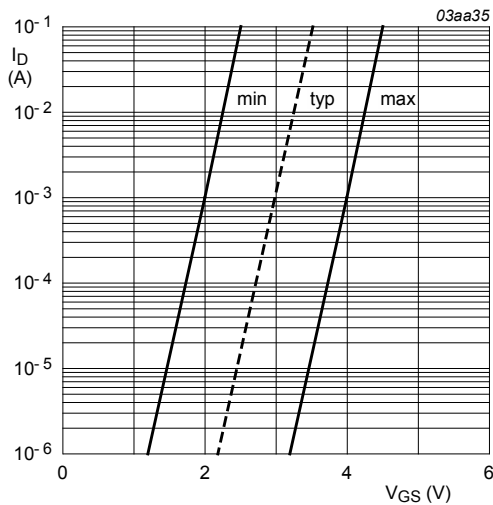


Fig. 11. Sub-threshold drain current as a function of gate-source voltage

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

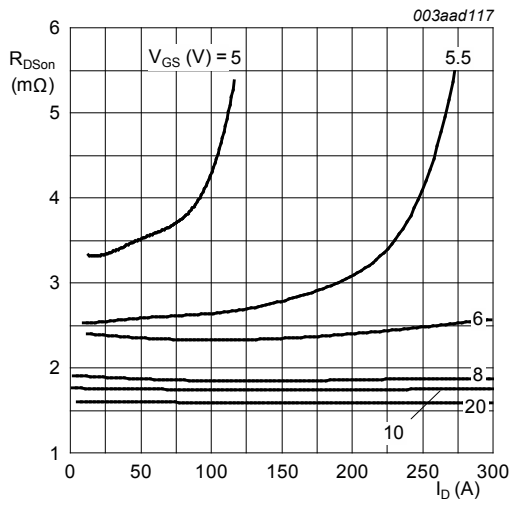


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

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

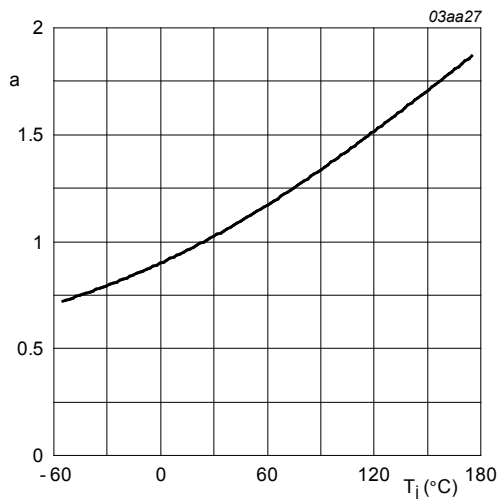


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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

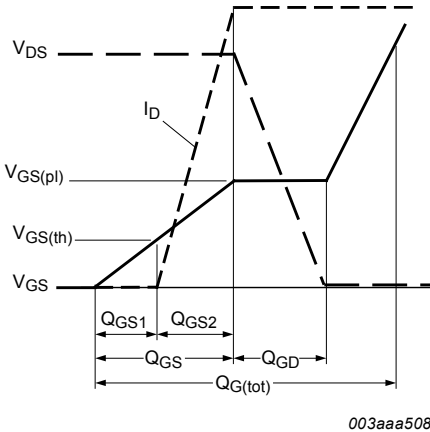


Fig. 14. Gate charge waveform definitions

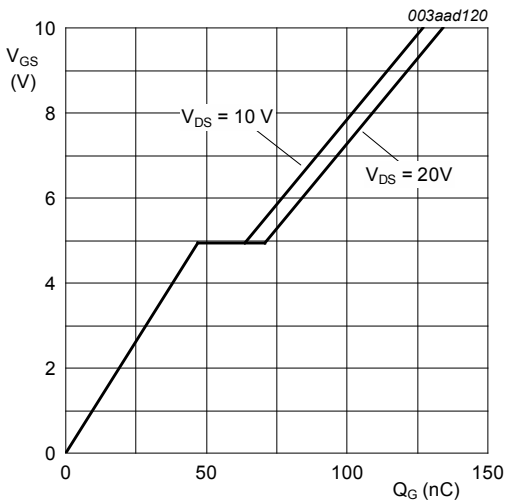


Fig. 15. Gate-source voltage as a function of gate charge; typical values

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

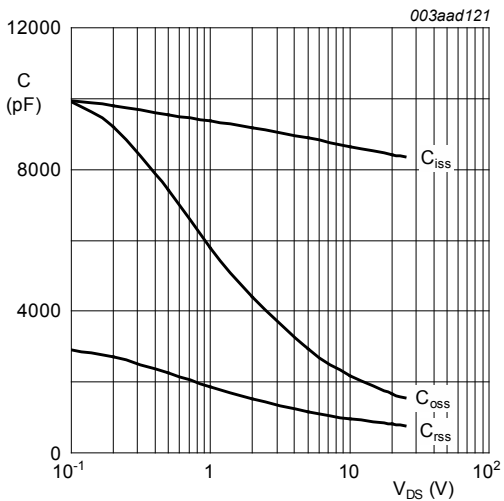


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

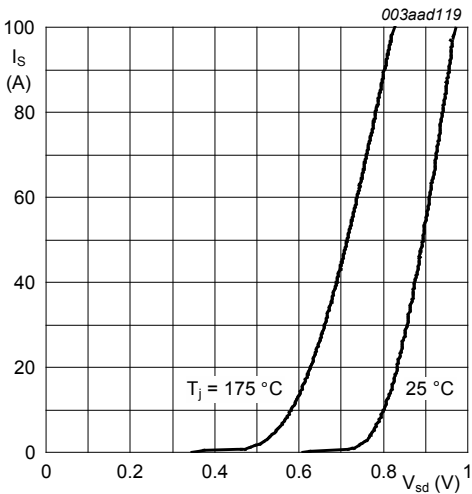


Fig. 17. Source current as a function of source-drain voltage; typical values

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

11. Package outline



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

12. Legal information

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Document status [1][2]	Product status [3]	Definition
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Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
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