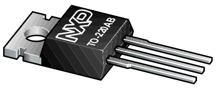

PSMN3R3-100PSF

N-channel 100 V 3.3 mΩ standard level MOSFET in TO-220 using NextPower technology

10 June 2014 Preliminary data sheet

1. General description

Standard level N-channel MOSFET in a TO-220 package, using NextPower technology and qualified to 175 °C. This product is designed and qualified for use in a wide range of power supply, industrial and telecom equipment.

2. Features and benefits

- NextPower technology optimised for low $R_{DS(on)}$, low Q_{RR}, low Q_G and low Q_{GD}
- Coss is optimised for low spiking and soft recovery
- Recommended for high system efficiency and low EMI designs
- Suitable for standard level gate drive sources

3. Applications

- Synchronous rectification
- Primary side switching in DC-to-DC power converters
- Motor control
- Load switching

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	-	100	V
I_D	drain current	T_{mb} = 25 °C; V_{GS} = 10 V; Fig. 2	[1][2]	-	-	100	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 1		-	-	441	W
T_j	junction temperature			-55	-	175	°C
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 100 °C; Fig. 10; Fig. 11		-	4.2	5	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; Fig. 10	[3]	-	2.8	3.3	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	V_{GS} = 10 V; I_D = 25 A; V_{DS} = 50 V; Fig. 12; Fig. 13		-	34.5	-	nC
$Q_{G(tot)}$	total gate charge			-	134.8	-	nC

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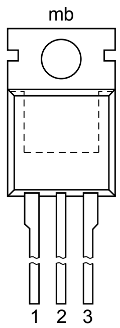
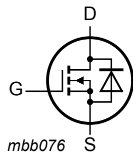
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; I_D = 66 A; V_{sup} ≤ 100 V; R_{GS} = 50 Ω; Unclamped; Fig. 4	[4]	-	-	1021	mJ

[1] Continuous current limited by package
[2] Avalanche current is limited by IAS
[3] Measured 3 mm from package.
[4] Protected by 100% test

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	mounting base; connected to drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN3R3-100PSF	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
PSMN3R3-100PSF	PSMN3R3-100PSF

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	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	100	V
V_{DGR}	drain-gate voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C; R_{GS} = 20 kΩ		-	100	V
V_{GS}	gate-source voltage			-20	20	V
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 1		-	441	W
I_D	drain current	V_{GS} = 10 V; T_j = 100 °C; Fig. 2	[1][2]	-	100	A
		V_{GS} = 10 V; T_{mb} = 25 °C; Fig. 2	[1][2]	-	100	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10$ µs; T_{mb} = 25 °C; Fig. 3		-	400	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 °C	[1]	-	100	A
I_{SM}	peak source current	pulsed; $t_p \leq 10$ µs; T_{mb} = 25 °C		-	400	A
Avalanche ruggedness						
I_{AS}	non-repetitive avalanche current	$V_{sup} \leq 100$ V; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; R_{GS} = 50 Ω	[3]	-	66	A
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; I_D = 66 A; $V_{sup} \leq 100$ V; R_{GS} = 50 Ω; Unclamped; Fig. 4	[3]	-	1021	mJ

[1] Continuous current limited by package

[2] Avalanche current is limited by IAS

[3] Protected by 100% test

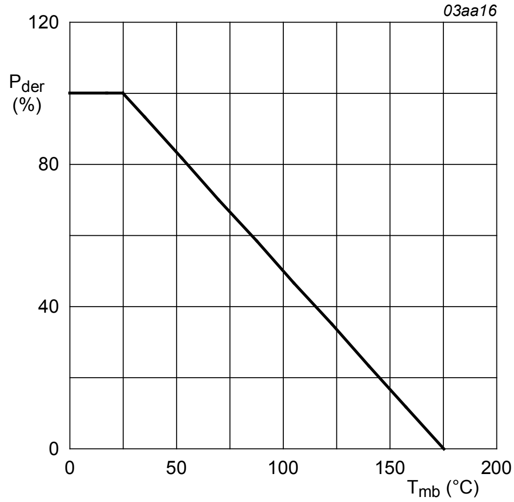
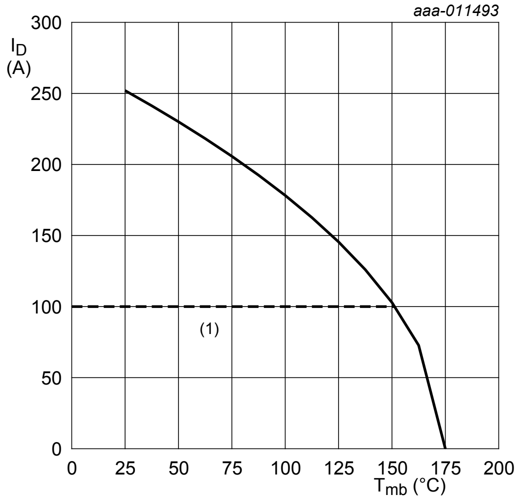


Fig. 1. Normalized total power dissipation as a function of mounting base temperature

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



(1) Capped at 100A due to package

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

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

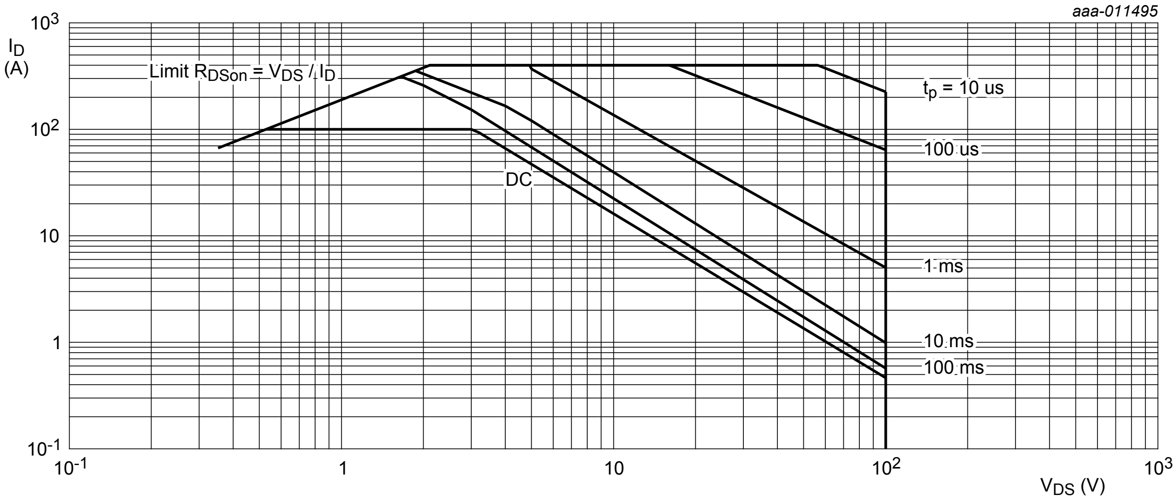


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

T_{mb} = 25 °C; I_{DM} is a single pulse; Capped at 100 A due to package

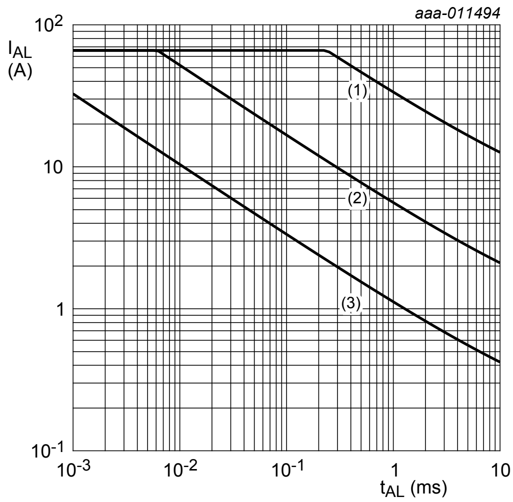


Fig. 4. Avalanche rating; avalanche current as a function of avalanche time

(1) $T_{j\,(init)} = 25°C$; (2) $T_{j\,(init)} = 150°C$; (3) Repetitive Avalanche

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	0.34	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in free air		-	60	-	K/W

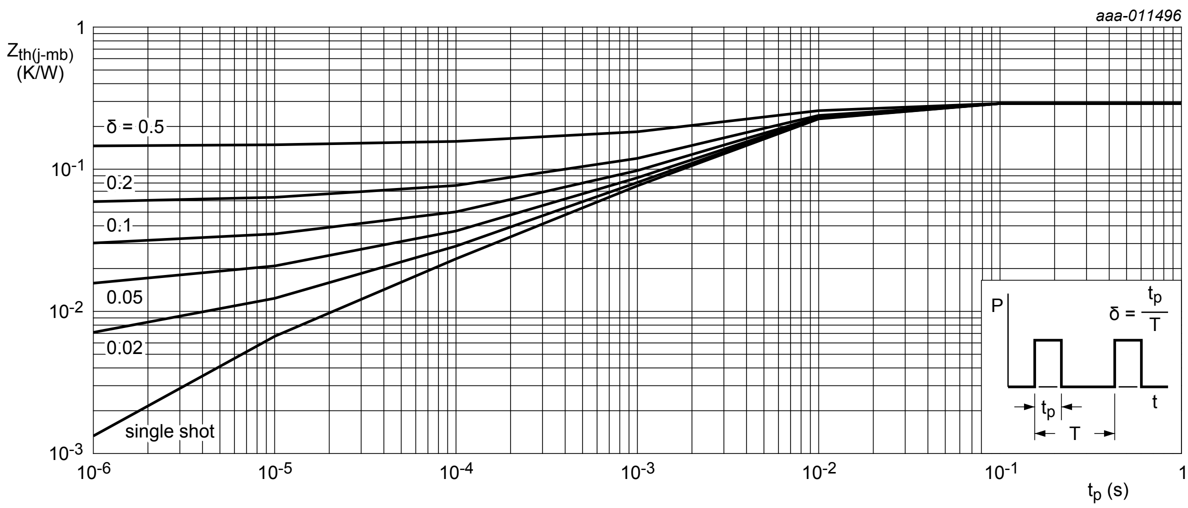


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C		100	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = -55 °C		90	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C		-	3.4	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °C		-	1.6	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; Fig. 9		2	3	4	V
$\Delta V_{GS(th)}/\Delta T$	gate-source threshold voltage variation with temperature	25 °C ≤ T_j ≤ 150 °C		-	-9	-	mV/K
I_{DSS}	drain leakage current	V_{DS} = 100 V; V_{GS} = 0 V; T_j = 25 °C		-	0.05	1	µA
		V_{DS} = 100 V; V_{GS} = 0 V; T_j = 125 °C		-	-	100	µA
I_{GSS}	gate leakage current	V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 °C		-	5	100	nA
		V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 °C		-	5	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 175 °C; Fig. 10; Fig. 11		-	5.9	7	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 100 °C; Fig. 10; Fig. 11		-	4.2	5	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; Fig. 10	[1]	-	2.8	3.3	mΩ
R_G	gate resistance	f = 1 MHz		-	1.5	-	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 25 A; V_{DS} = 50 V; V_{GS} = 10 V; Fig. 12; Fig. 13		-	134.8	-	nC
		I_D = 0 A; V_{DS} = 0 V; V_{GS} = 10 V; Fig. 13; Fig. 12		-	111	-	nC
Q_{GS}	gate-source charge	I_D = 25 A; V_{DS} = 50 V; V_{GS} = 10 V; Fig. 12; Fig. 13		-	36.7	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge			-	23	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge			-	13.7	-	nC
Q_{GD}	gate-drain charge			-	34.5	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	I_D = 25 A; V_{DS} = 50 V; Fig. 12; Fig. 13		-	4.65	-	V
C_{iss}	input capacitance	V_{DS} = 50 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; Fig. 14		-	9195	-	pF
C_{oss}	output capacitance			-	2349	-	pF

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
C_{rss}	reverse transfer capacitance			-	16	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 50 V; R_L = 2 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 5 Ω; I_D = 25 A; T_j = 25 °C		-	37	-	ns
t_r	rise time			-	57	-	ns
$t_{d(off)}$	turn-off delay time			-	92	-	ns
t_f	fall time			-	60	-	ns
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; T_j = 25 °C; Fig. 15		-	0.8	1.2	V
t_{rr}	reverse recovery time	I_S = 25 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 50 V		-	79	-	ns
Q_r	recovered charge			-	152	-	nC

[1] Measured 3 mm from package.

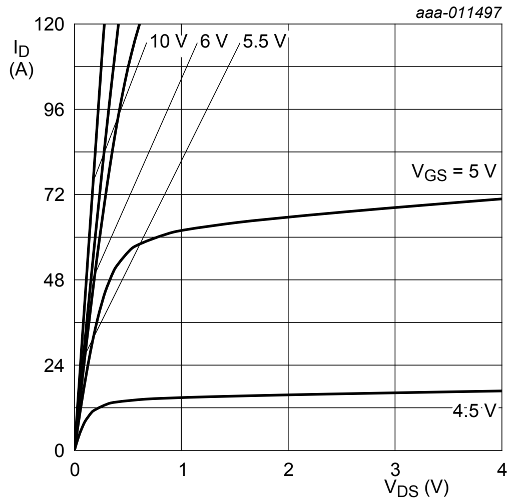


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

$T_j = 25$ °C; $t_p = 300$ µs

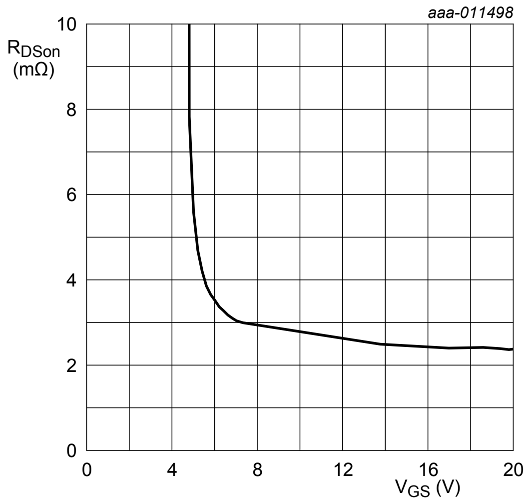


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25$ °C; $I_D = 25$ A

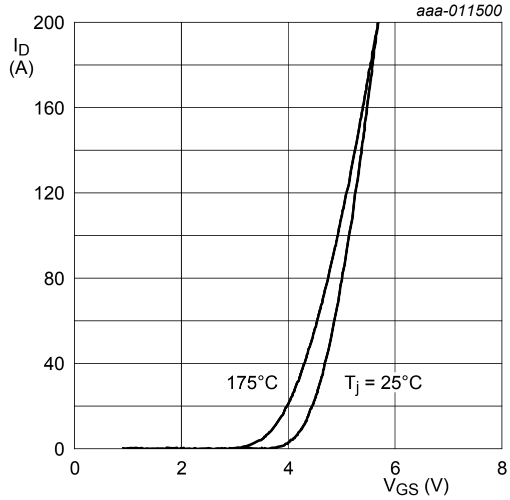


Fig. 8. Transfer characteristics: drain current as a function of gate-source voltage; typical values

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

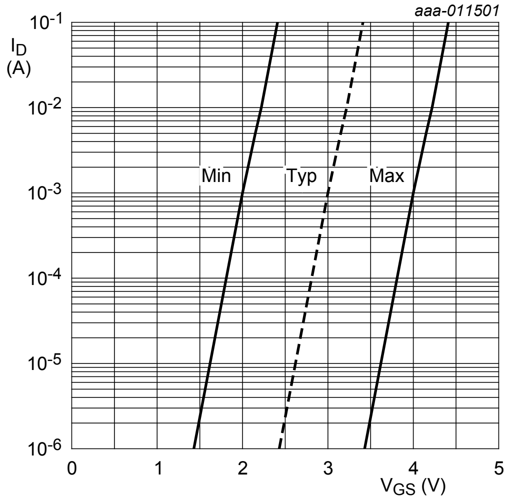


Fig. 9. Sub-threshold drain current as a function of gate-source voltage

$T_j = 25°C;\ V_{DS} = 5V$

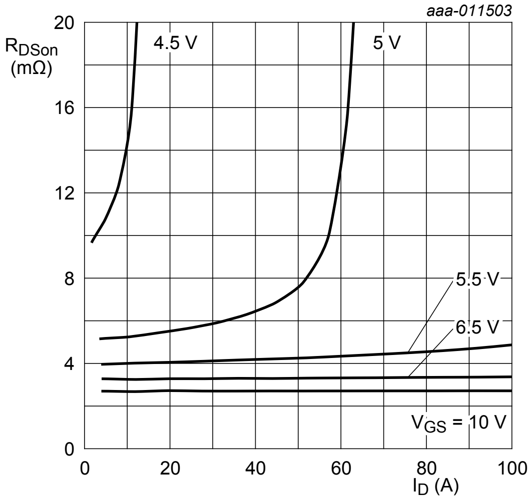


Fig. 10. Drain-source on-state resistance as a function of drain current; typical values

$T_j = 25\text{ °C};\ t_p = 300\ \mu s$

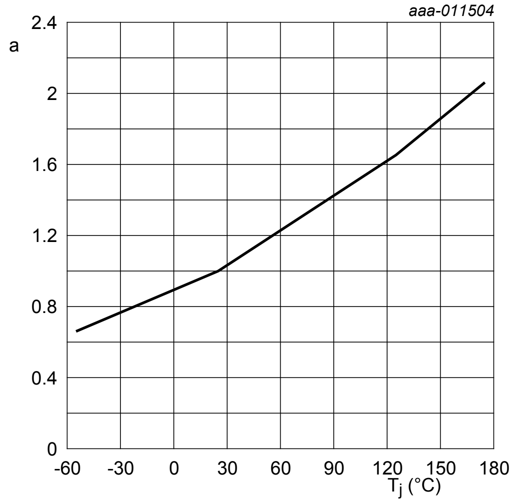


Fig. 11. Normalized drain-source on-state resistance factor as a function of junction temperature

$$a = \frac{R_{DSon}}{R_{DSon(25\,°C)}}$$

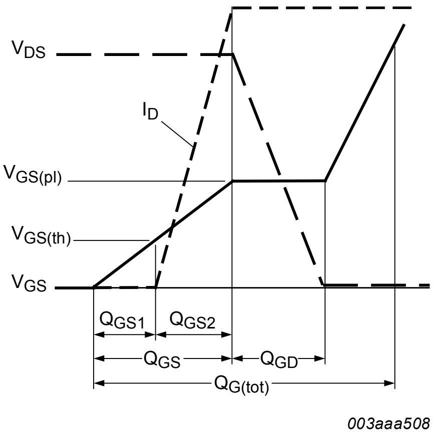


Fig. 12. Gate charge waveform definitions

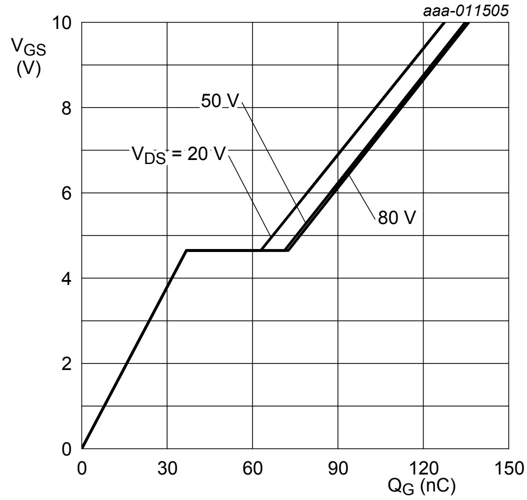


Fig. 13. Gate-source voltage as a function of gate charge; typical values

$T_j = 25\ °C; I_D = 25\ A$

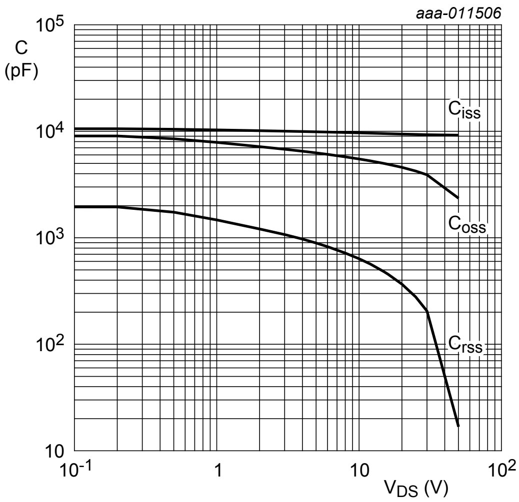


Fig. 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

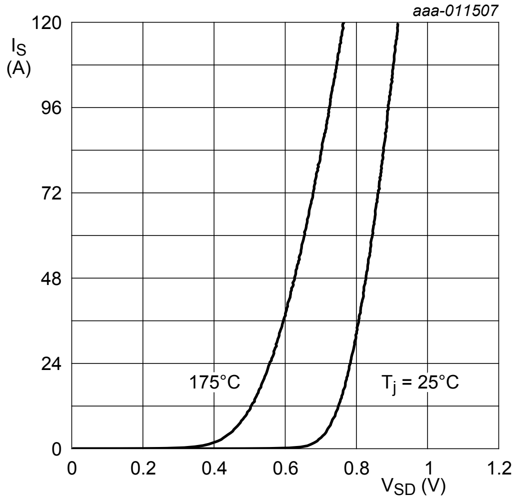
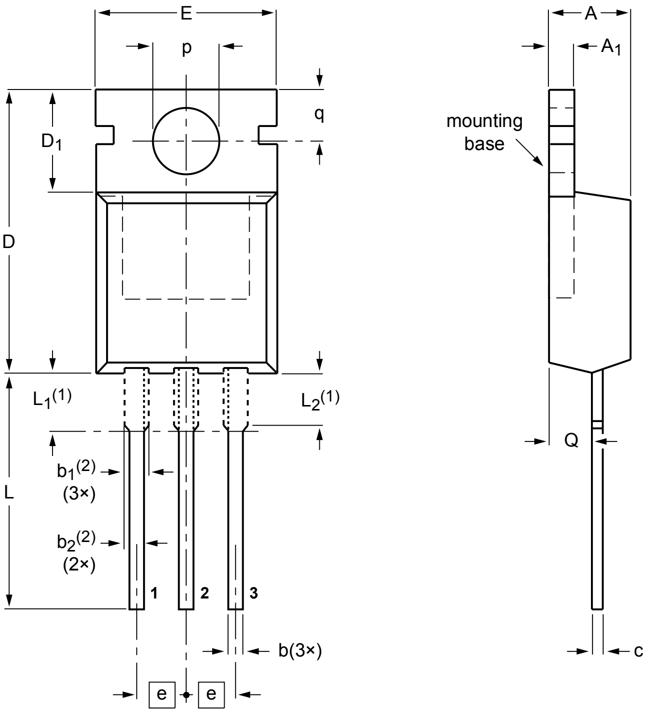


Fig. 15. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

$V_{GS} = 0\ V$

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_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 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.

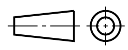
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			~~08-04-23~~ 08-06-13

Fig. 16. 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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Date of release: 10 June 2014