PSMN9R5-100PS

N-channel 100 V 9.6 mΩ standard level MOSFET in T0220

17 October 2013 Product data sheet

1. General description

Standard level N-channel MOSFET in a TO220 packages qualified to 175C. 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

3. Applications

- DC-to-DC converters
- 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	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	-	100	V
I_D	drain current	$T_{mb} = 25$ °C; $V_{GS} = 10$ V; Fig. 1		-	-	89	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; Fig. 2		-	-	211	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10$ V; $I_D = 15$ A; $T_j = 25$ °C; Fig. 13		-	8.16	9.6	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	$V_{GS} = 10$ V; $I_D = 60$ A; $V_{DS} = 50$ V; Fig. 14; Fig. 15		-	23	-	nC
$Q_{G(tot)}$	total gate charge			-	82	-	nC
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10$ V; $T_{j(init)} = 25$ °C; $I_D = 89$ A; $V_{sup} \leq 100$ V; unclamped; $R_{GS} = 50$ Ω		-	-	177	mJ

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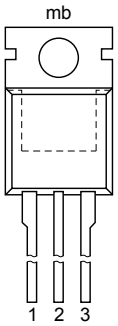
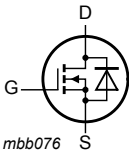
5. Pinning information

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
PSMN9R5-100PS	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
PSMN9R5-100PS	PSMN9R5-100PS

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	$T_j \leq 175$ °C; $T_j \geq 25$ °C; $R_{GS} = 20$ kΩ		-	100	V
V_{GS}	gate-source voltage			-20	20	V
I_D	drain current	$V_{GS} = 10$ V; $T_{mb} = 100$ °C; Fig. 1		-	63	A
		$V_{GS} = 10$ V; $T_{mb} = 25$ °C; Fig. 1		-	89	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10$ µs; $T_{mb} = 25$ °C; Fig. 3		-	355	A

Symbol	Parameter	Conditions		Min	Max	Unit
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 2		-	211	W
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		-	89	A
I_{SM}	peak source current	pulsed; $t_p \leq 10$ µs; T_{mb} = 25 °C		-	355	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; I_D = 89 A; $V_{sup} \leq 100$ V; unclamped; R_{GS} = 50 Ω		-	177	mJ

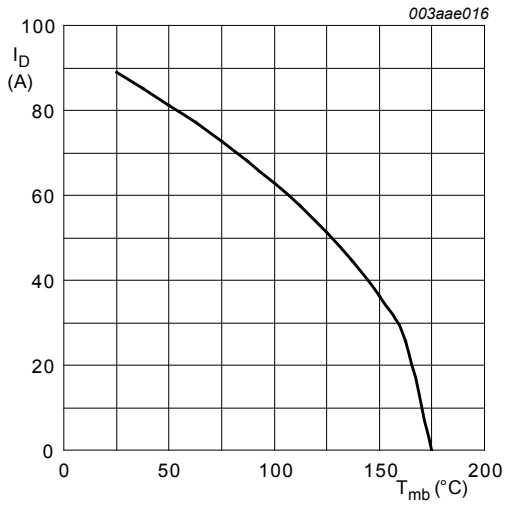


Fig. 1. Continuous drain current as a function of mounting base temperature

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

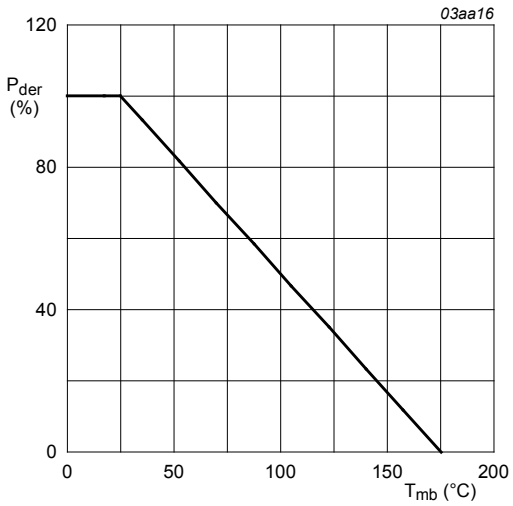


Fig. 2. Normalized total power dissipation as a function of mounting base temperature

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

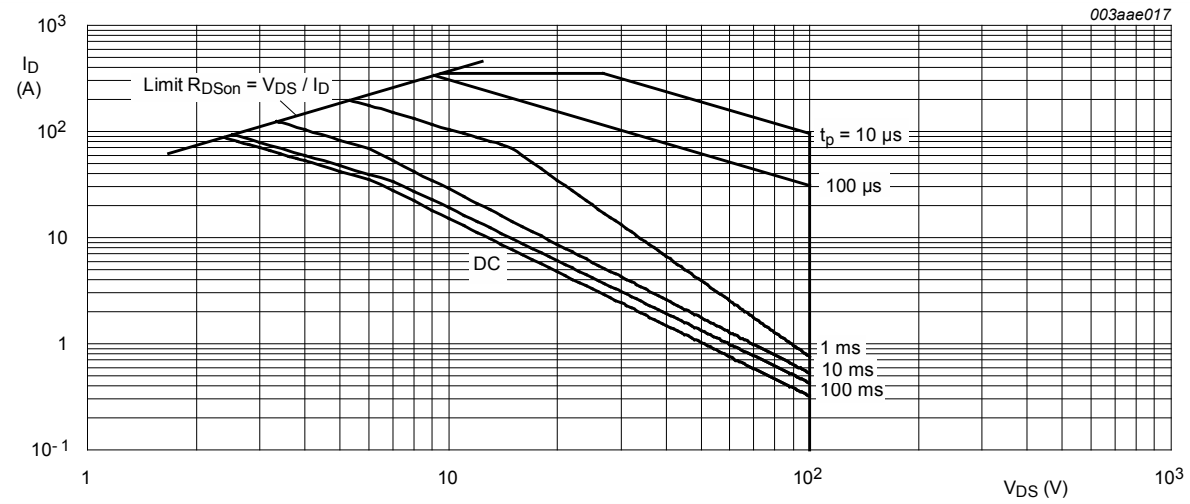


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25\,°C; I_{DM}$ 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. 4		-	0.38	0.71	K/W

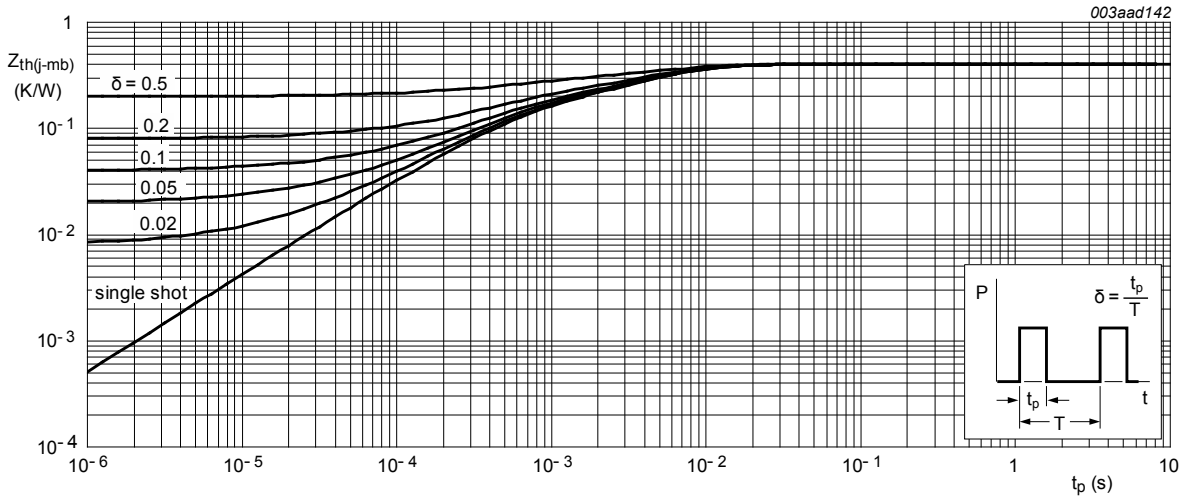


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 0.25 mA; V_{GS} = 0 V; T_j = -55 °C		90	-	-	V
		I_D = 0.25 mA; V_{GS} = 0 V; T_j = 25 °C		100	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °C; Fig. 10; Fig. 11		1	-	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; Fig. 10; Fig. 11		2	3	4	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; Fig. 10; Fig. 11		-	-	4.8	V
I_{DSS}	drain leakage current	V_{DS} = 100 V; V_{GS} = 0 V; T_j = 125 °C		-	-	100	µA
		V_{DS} = 100 V; V_{GS} = 0 V; T_j = 25 °C		-	0.02	4	µA
I_{GSS}	gate leakage current	V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 °C		-	10	100	nA
		V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 °C		-	10	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 15 A; T_j = 100 °C; Fig. 12		-	-	17.3	mΩ
		V_{GS} = 10 V; I_D = 15 A; T_j = 175 °C; Fig. 12		-	23.5	27.4	mΩ
		V_{GS} = 10 V; I_D = 15 A; T_j = 25 °C; Fig. 13		-	8.16	9.6	mΩ
R_G	internal gate resistance (AC)	f = 1 MHz		-	0.7	-	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 0 A; V_{DS} = 0 V; V_{GS} = 10 V; Fig. 14		-	67	-	nC
		I_D = 60 A; V_{DS} = 50 V; V_{GS} = 10 V; Fig. 14; Fig. 15		-	82	-	nC
Q_{GS}	gate-source charge			-	21	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge	I_D = 60 A; V_{DS} = 50 V; V_{GS} = 3 V; Fig. 14		-	13.1	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge	I_D = 60 A; V_{DS} = 50 V; V_{GS} = 10 V; Fig. 14		-	7.8	-	nC
Q_{GD}	gate-drain charge	I_D = 60 A; V_{DS} = 50 V; V_{GS} = 10 V; Fig. 14; Fig. 15		-	23	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	V_{DS} = 50 V; Fig. 14; Fig. 15		-	4.5	-	V
C_{iss}	input capacitance	V_{DS} = 50 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; Fig. 16		-	4454	-	pF
C_{oss}	output capacitance			-	302	-	pF

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
C_{rss}	reverse transfer capacitance			-	185	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 50 V; R_L = 0.8 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 4.7 Ω; T_j = 25 °C		-	22	-	ns
t_r	rise time			-	25.2	-	ns
$t_{d(off)}$	turn-off delay time			-	52.2	-	ns
t_f	fall time			-	22.8	-	ns
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 15 A; V_{GS} = 0 V; T_j = 25 °C; Fig. 17		-	0.85	1.2	V
t_{rr}	reverse recovery time	I_S = 20 A; dI_S/dt = 100 A/µs; V_{GS} = 0 V; V_{DS} = 50 V		-	61.5	-	ns
Q_r	recovered charge			-	157	-	nC

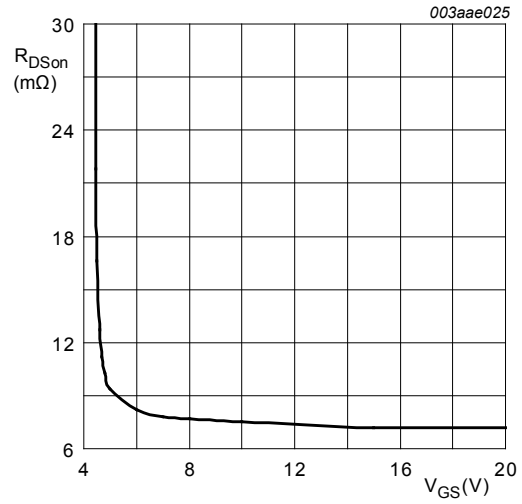


Fig. 5. Drain-source on-state resistance as a function of gate-source voltage; typical values.

$T_j = 25\ °C; I_D = 20\ A$

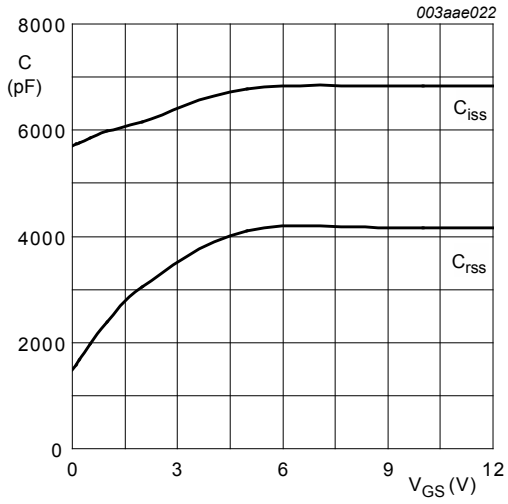


Fig. 6. Input and reverse transfer capacitances as a function of gate-source voltage; typical values

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

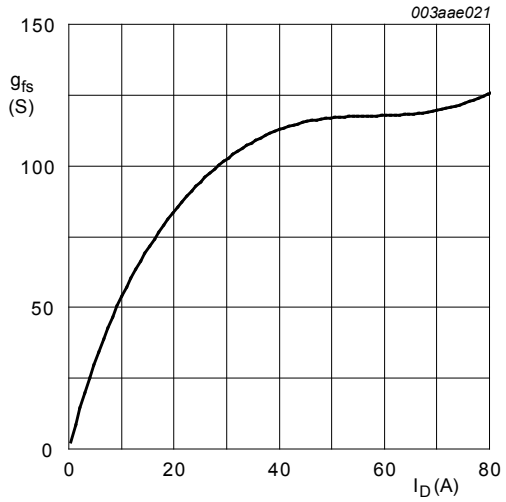


Fig. 7. Forward transconductance as a function of drain current; typical values

$T_j = 25\,°C; V_{DS} = 25V$

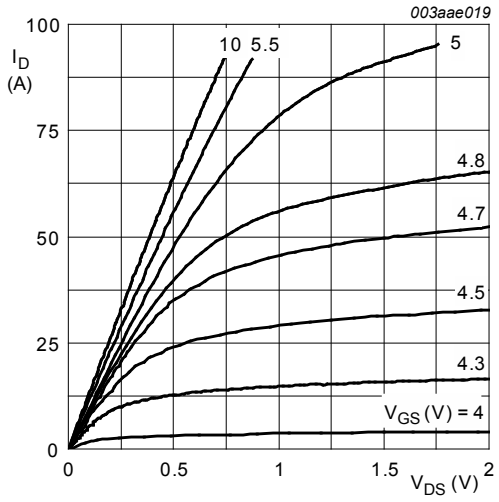


Fig. 8. Output characteristics: drain current as a function of drain-source voltage; typical values

$T_j = 25\,°C$

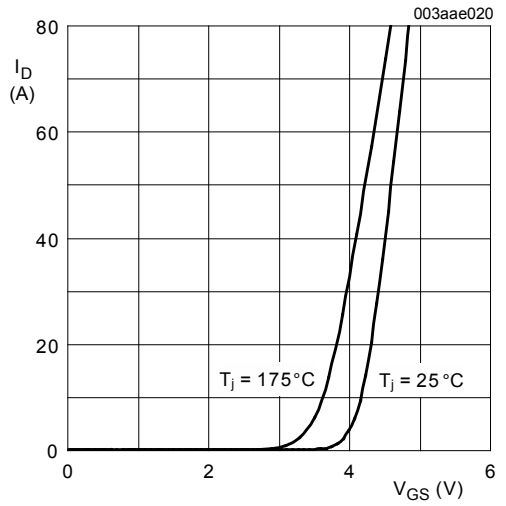


Fig. 9. Transfer characteristics: drain current as a function of gate-source voltage; typical valuesvalues

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

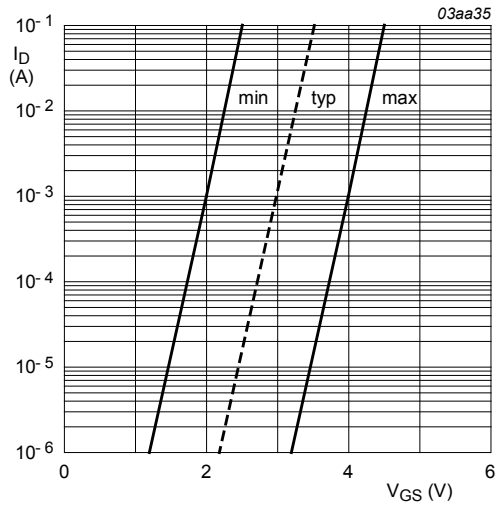


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

$T_j = 25\,°C; V_{DS} = 5V$

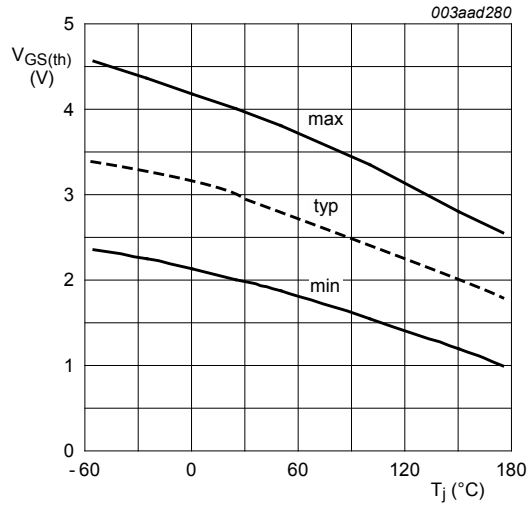


Fig. 11. Gate-source threshold voltage as a function of junction temperature

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

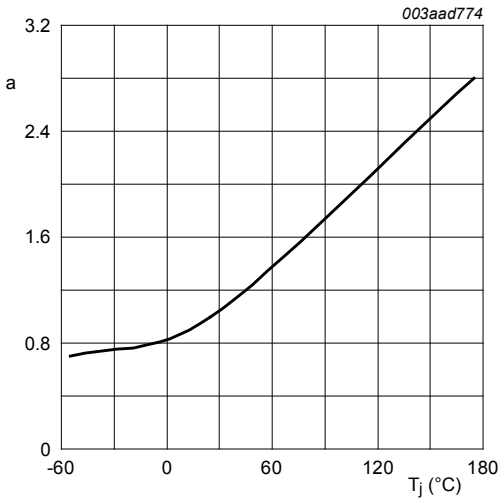


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

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

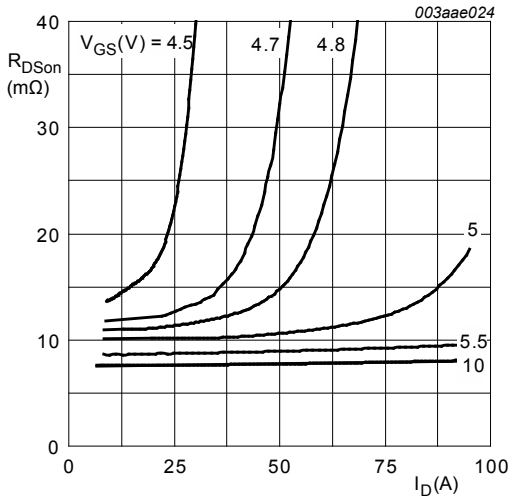


Fig. 13. Drain-source on-state resistance as a function of drain current; typical values

$T_j = 25\,°C$

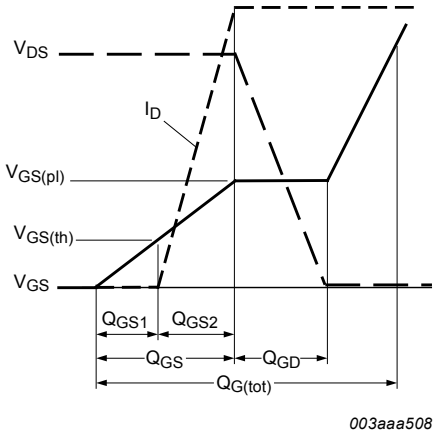


Fig. 14. Gate charge waveform definitions

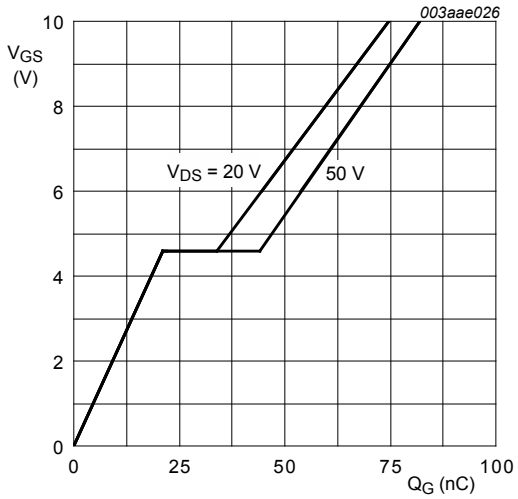


Fig. 15. Gate-source voltage as a function of gate charge; typical values

$T_j = 25\ °C;\ I_D = 60\ A$

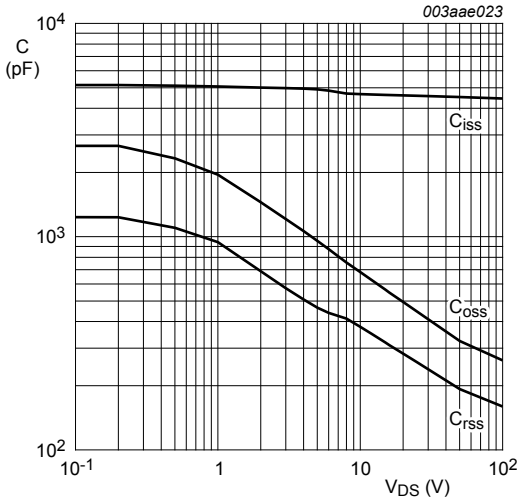


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

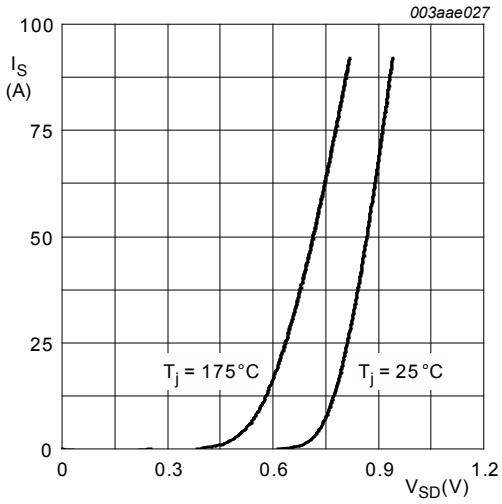
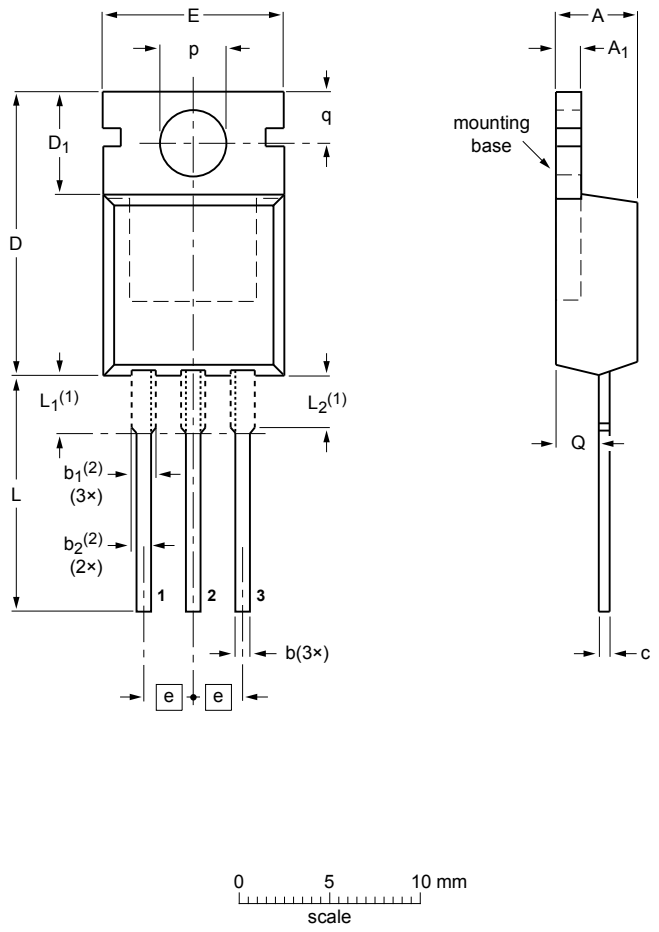


Fig. 17. Source current as a function of source-drain voltage; typical values

$V_{GS} = 0\ V$

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. 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".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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