PSMN3R0-60PS

N-channel 60 V 3.0 mΩ standard level MOSFET

Rev. 02 — 28 October 2010 Product data sheet

1. Product profile

1.1 General description

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

1.2 Features and benefits

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

1.3 Applications

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

1.4 Quick reference data

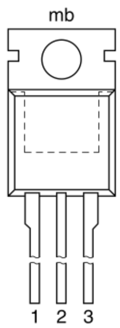
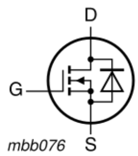
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	-	60	V
I_D	drain current	$T_{mb} = 25$ °C; $V_{GS} = 10$ V; see Figure 1	[1]	-	-	100	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; see Figure 2		-	-	306	W
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10$ V; $I_D = 25$ A; $T_j = 25$ °C; see Figure 11; see Figure 12		-	2.4	3	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	$V_{GS} = 10$ V; $I_D = 80$ A; $V_{DS} = 12$ V; see Figure 13; see Figure 14		-	28	-	nC
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10$ V; $T_{j(init)} = 25$ °C; $I_D = 100$ A; $V_{sup} \leq 60$ V; $R_{GS} = 50$ Ω; unclamped		-	-	800	mJ

[1] Continuous current is limited by package.

2. Pinning information

Table 2. Pinning information

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

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN3R0-60PS	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

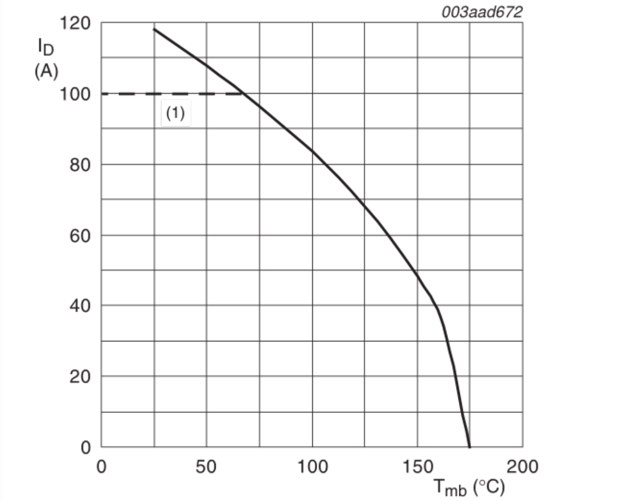
4. Limiting values

Table 4. Limiting values

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

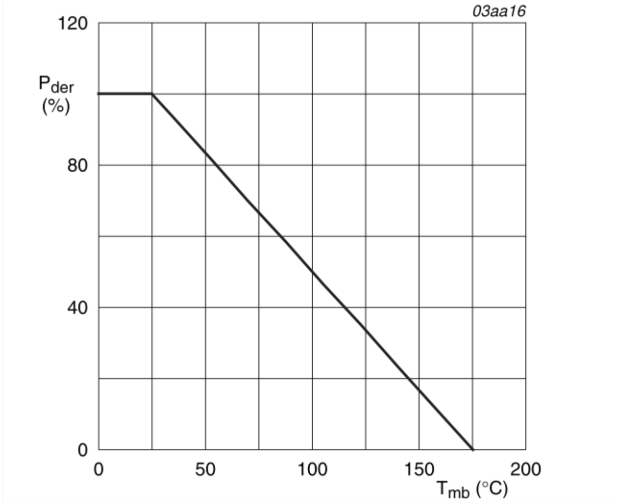
Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	60	V
V_{DGR}	drain-gate voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C; $R_{GS} = 20$ kΩ		-	60	V
V_{GS}	gate-source voltage			-20	20	V
I_D	drain current	$V_{GS} = 10$ V; $T_{mb} = 100$ °C; see Figure 1		-	83.4	A
		$V_{GS} = 10$ V; $T_{mb} = 25$ °C; see Figure 1	[1]	-	100	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10$ µs; $T_{mb} = 25$ °C; see Figure 3		-	824	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; see Figure 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	[1]	-	100	A
I_{SM}	peak source current	pulsed; $t_p \leq 10$ µs; $T_{mb} = 25$ °C		-	824	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10$ V; $T_{j(init)} = 25$ °C; $I_D = 100$ A; $V_{sup} \leq 60$ V; $R_{GS} = 50$ Ω; unclamped		-	800	mJ

[1] Continuous current is limited by package.



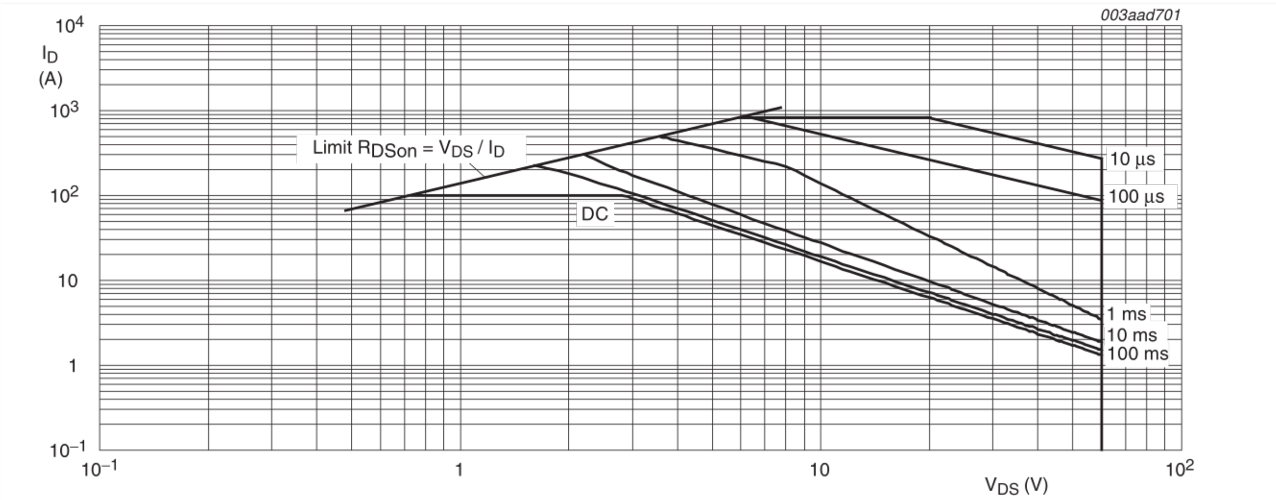
$V_{GS} \geq 10$ V(1) Capped at 100 A due to package

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



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

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



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

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

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 4	-	0.3	0.49	K/W

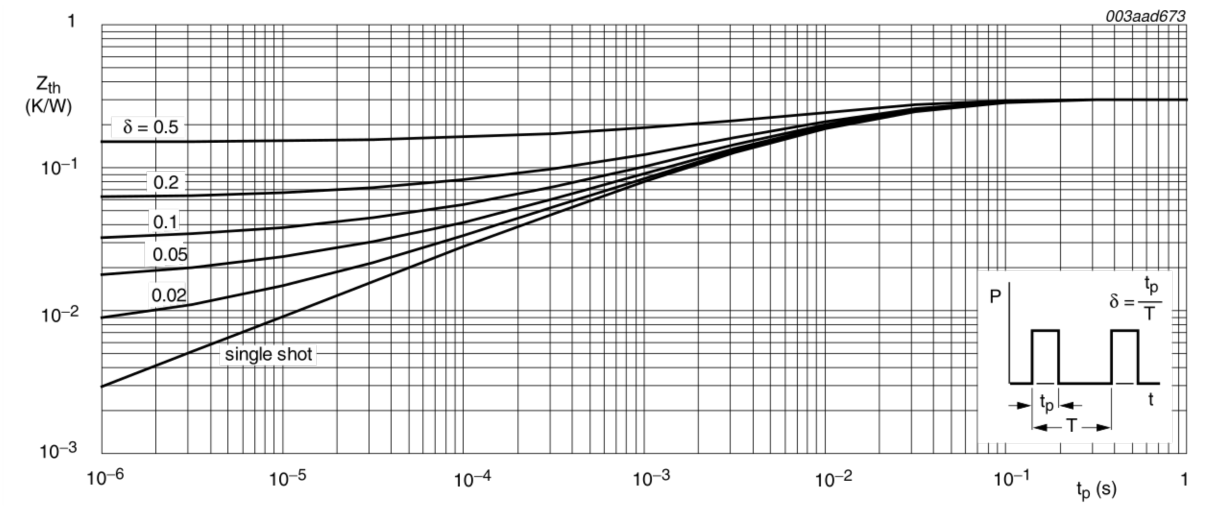
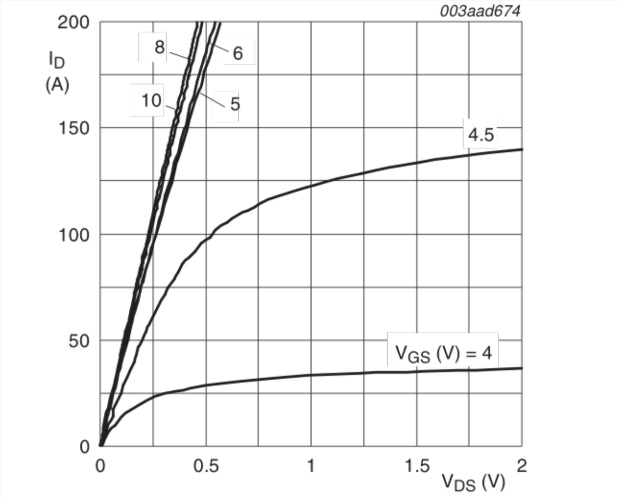


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

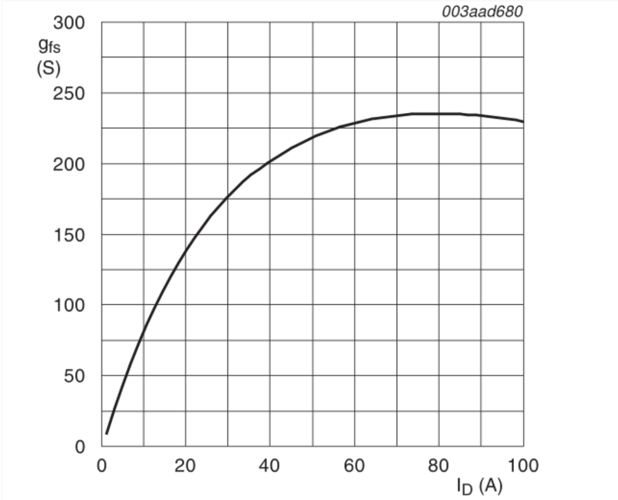
Table 6. Characteristics

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 = -55 °C	54	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C	60	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; see Figure 8; see Figure 9	2	3	4	V
V_{GSth}	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °C; see Figure 9	1	-	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; see Figure 9	-	-	4.6	V
I_{DSS}	drain leakage current	V_{DS} = 60 V; V_{GS} = 0 V; T_j = 25 °C	-	0.05	10	µA
		V_{DS} = 60 V; V_{GS} = 0 V; T_j = 175 °C	-	-	500	µA
I_{GSS}	gate leakage current	V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 °C	-	2	100	nA
		V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 °C	-	2	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 175 °C; see Figure 10	-	-	7.2	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; see Figure 11; see Figure 12	-	2.4	3	mΩ
R_G	gate resistance	f = 1 MHz	-	1.1	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = 80 A; V_{DS} = 12 V; V_{GS} = 10 V; see Figure 13; see Figure 14	-	130	-	nC
Q_{GS}	gate-source charge	I_D = 80 A; V_{DS} = 12 V; V_{GS} = 10 V; see Figure 14; see Figure 13	-	43	-	nC
Q_{GD}	gate-drain charge	I_D = 80 A; V_{DS} = 12 V; V_{GS} = 10 V; see Figure 13; see Figure 14	-	28	-	nC
C_{iss}	input capacitance	V_{DS} = 30 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; see Figure 15; see Figure 16	-	8079	-	pF
C_{oss}	output capacitance	V_{DS} = 30 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; see Figure 15	-	971	-	pF
C_{rss}	reverse transfer capacitance	V_{DS} = 30 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; see Figure 15; see Figure 16	-	492	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 30 V; R_L = 0.5 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 1.5 Ω	-	31	-	ns
t_r	rise time		-	26	-	ns
$t_{d(off)}$	turn-off delay time		-	77	-	ns
t_f	fall time		-	22	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; T_j = 25 °C; see Figure 17	-	0.88	1.2	V
t_{rr}	reverse recovery time	I_S = 25 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 30 V	-	54	-	ns
Q_r	recovered charge		-	97	-	nC



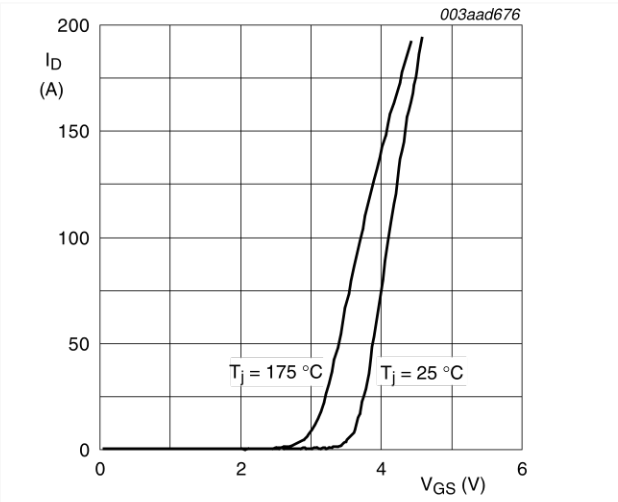
$T_j = 25\ °C;\ t_p = 300 \mu s$

Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values



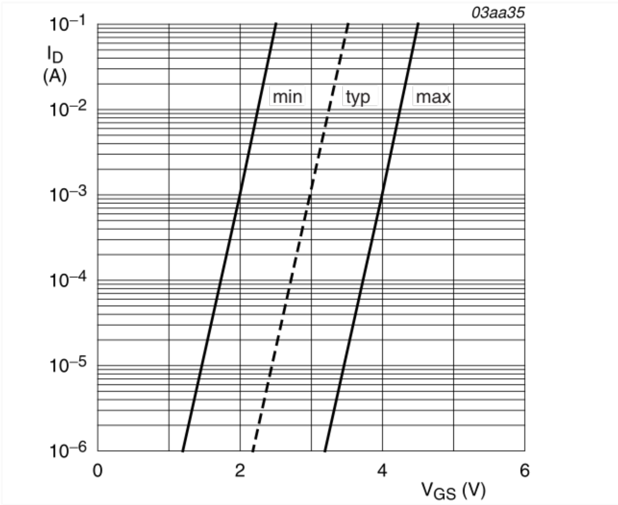
$T_j = 25\ °C;\ V_{DS} = 30 V$

Fig 6. Forward transconductance as a function of drain current; typical values



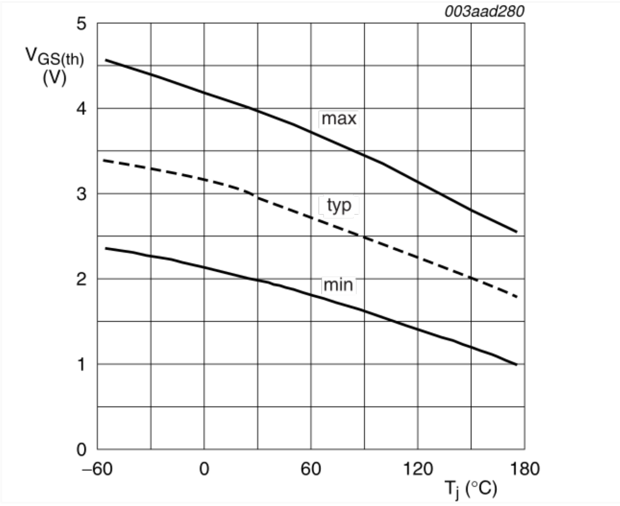
$V_{DS} = 30\ V$

Fig 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values



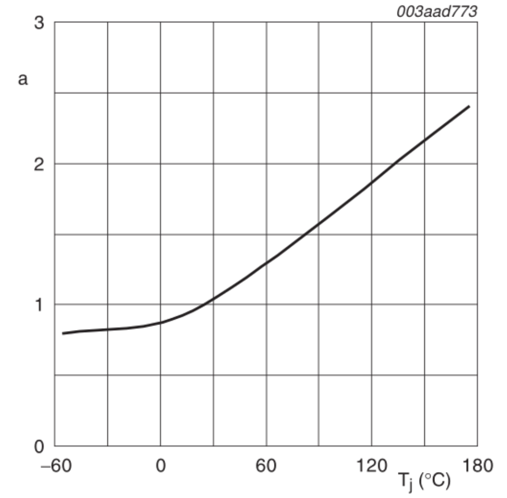
$T_j = 25\ °C;\ V_{DS} = 5 V$

Fig 8. Sub-threshold drain current as a function of gate-source voltage



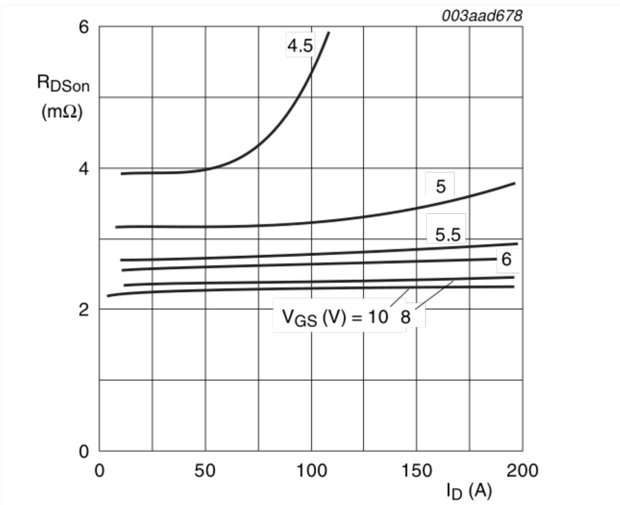
$I_D = 1\ \mathrm{mA};\ V_{DS} = V_{GS}$

Fig 9. Gate-source threshold voltage as a function of junction temperature



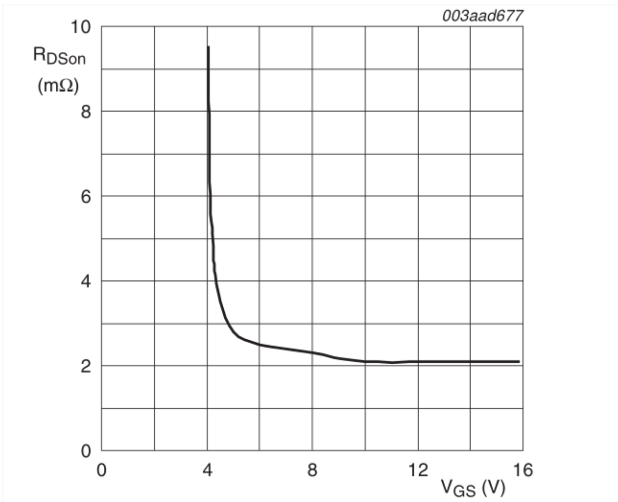
$$a = \frac{R_{DSon}}{R_{DSon(25\,°C)}}$$

Fig 10. Normalized drain-source on-state resistance factor as a function of junction temperature



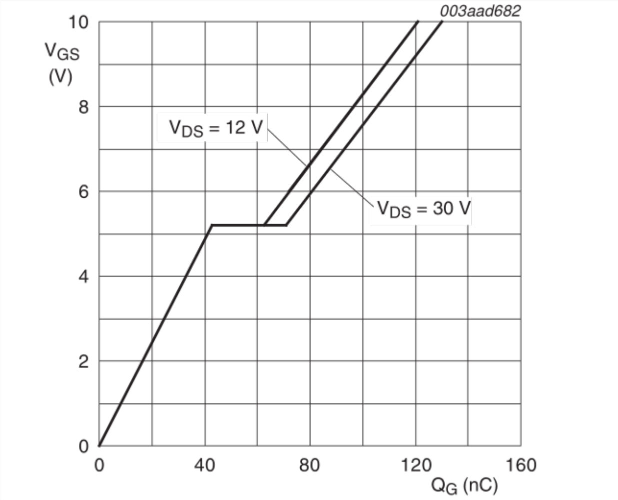
$T_j = 25\ °C;\ t_p = 300\ \mu s$

Fig 11. Drain-source on-state resistance as a function of drain current; typical values



$T_j = 25\ °C;\ I_D = 25\ \mathrm{A}$

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



$T_j = 25$ °C; $I_D = 80$ A

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

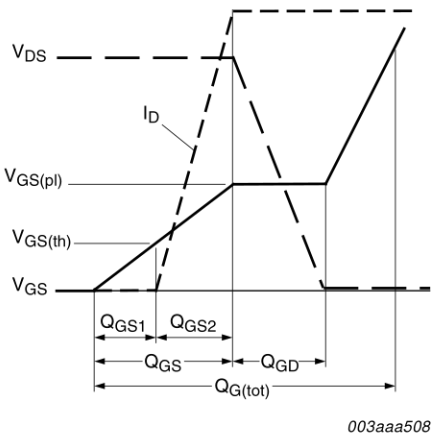
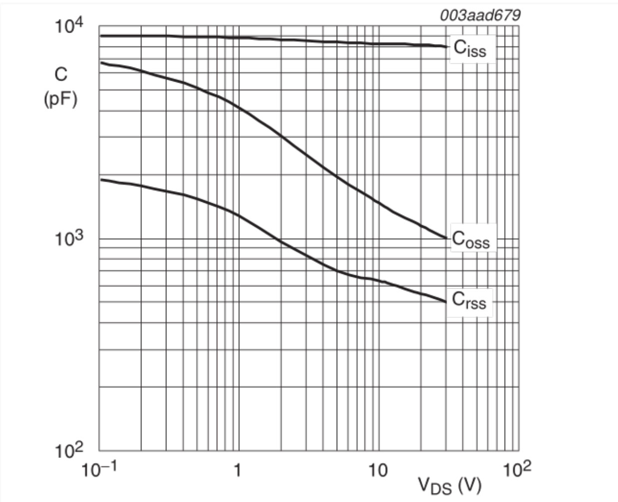
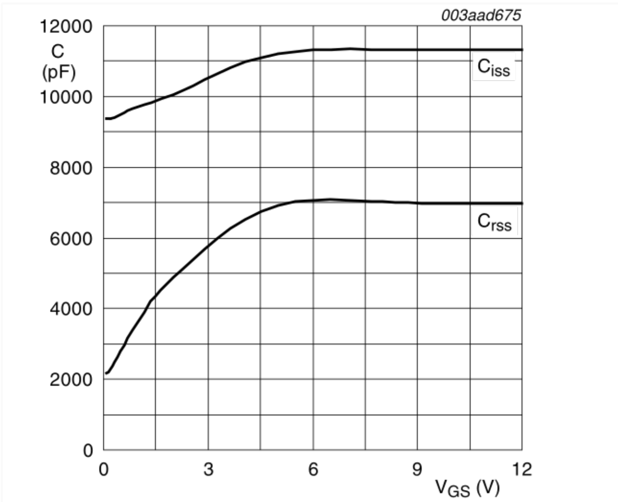


Fig 14. Gate charge waveform definitions



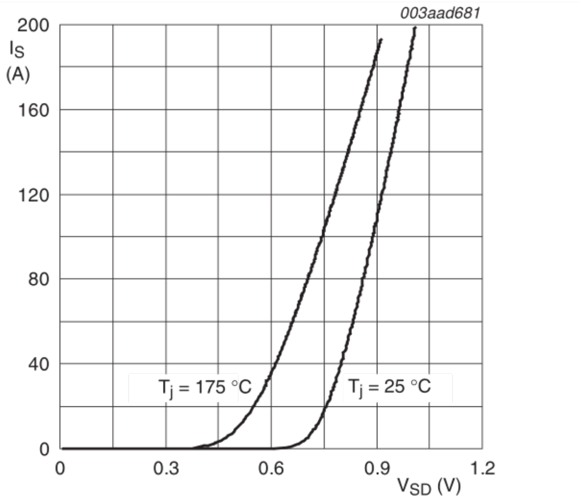
$V_{GS} = 0$ V; f = 1 MHz

Fig 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



f = 1 MHz

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

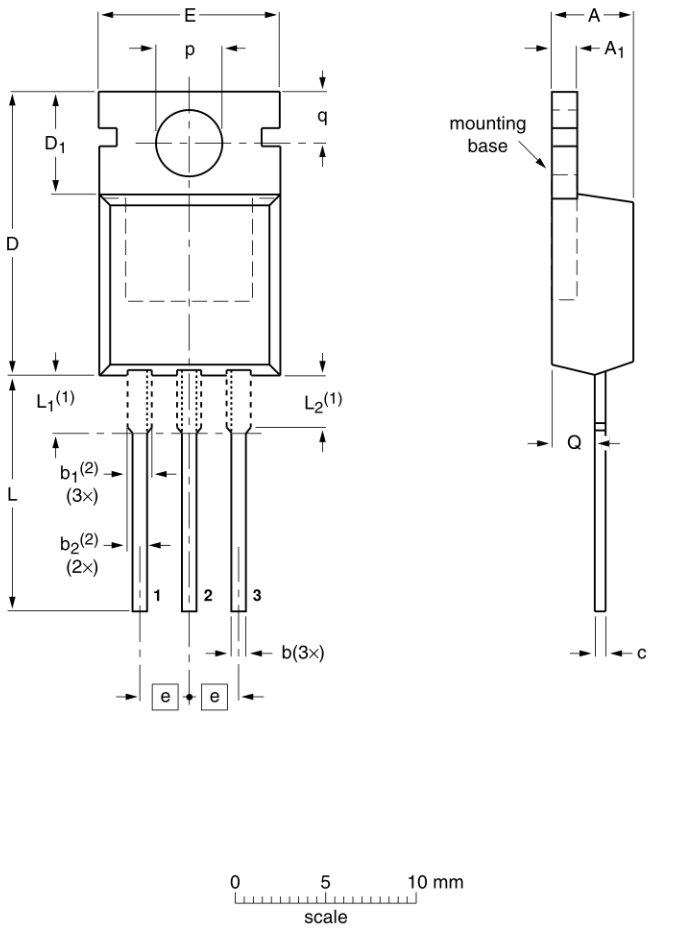


$V_{GS} = 0$ V

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

7. 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 SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN3R0-60PS v.2	20101028	Product data sheet	-	PSMN3R0-60PS v.1
Modifications:	• Various changes to content.			
PSMN3R0-60PS v.1	20091123	Product data sheet	-	-

9. Legal information

9.1 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.nexperia.com.

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11. Contents

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Date of release: 28 October 2010