



PSMN3R0-60PS

N-channel 60 V 3.0 m Ω 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
- Motor control
- Load switching
- Server power supplies

1.4 Quick reference data

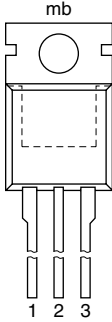
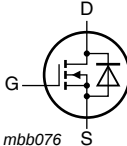
Table 1. Quick reference data

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

SOT78 (TO-220AB)

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

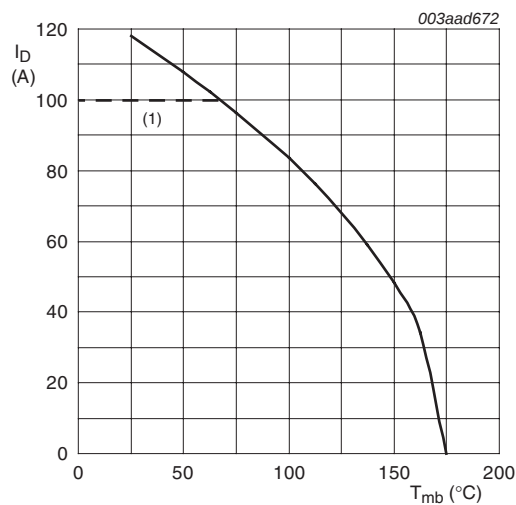
4. Limiting values

Table 4. Limiting values

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

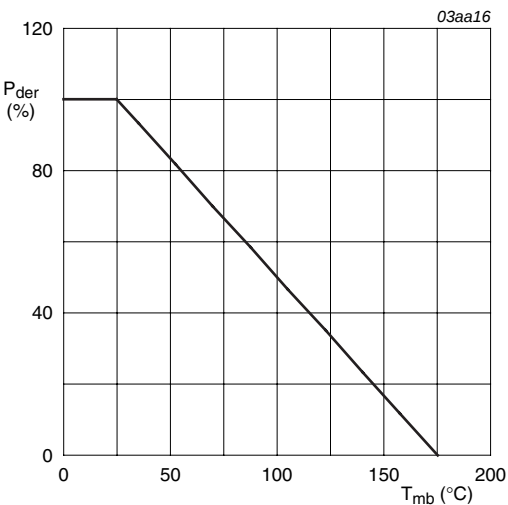
Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	60	V
V_{DGR}	drain-gate voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	60	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS}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

[1] Continuous current is limited by package.



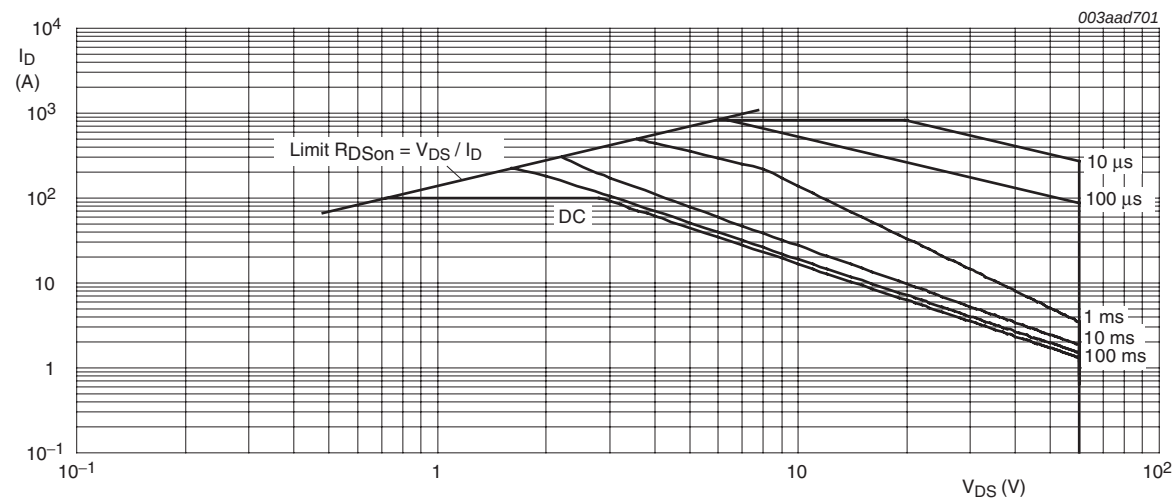
V_{GS} ≥ 10 V(1) Capped at 100 A due to package

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



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

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

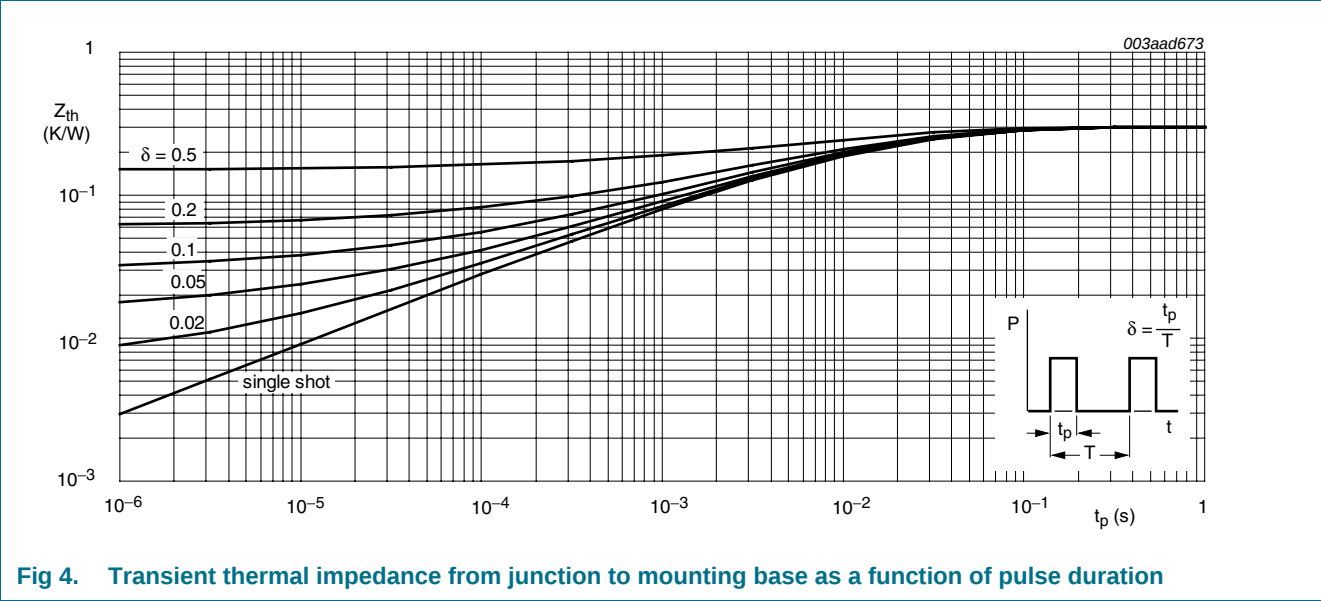
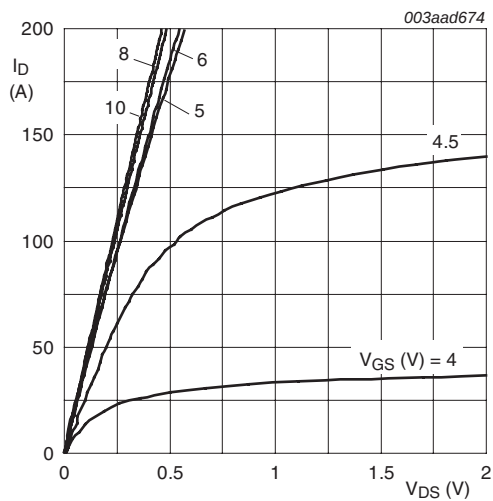


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

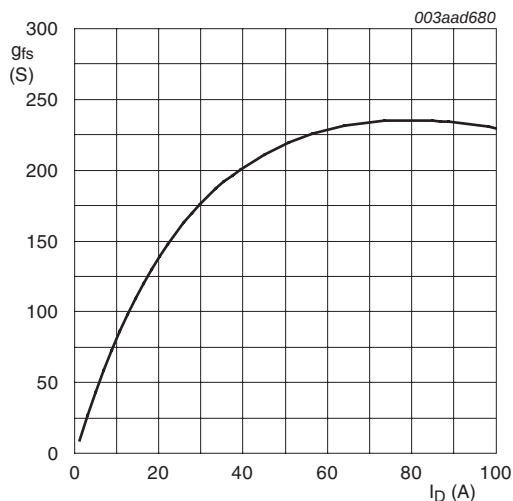
Table 6. Characteristics

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



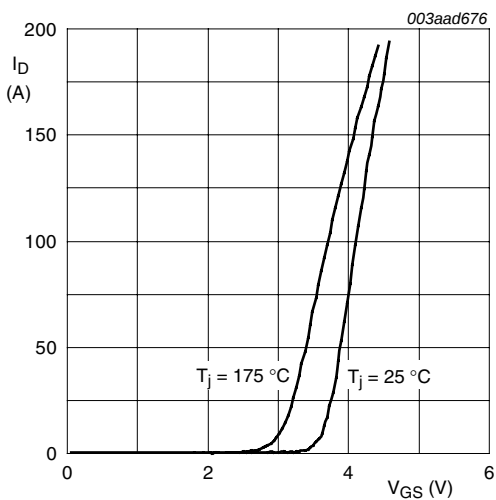
$T_j = 25\text{ }^{\circ}\text{C}; t_p = 300\mu\text{s}$

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



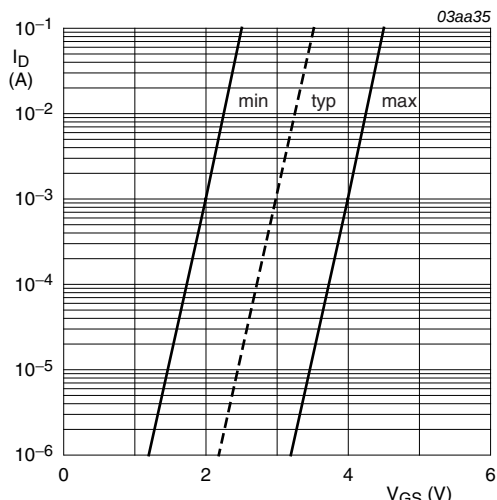
$T_j = 25\text{ }^{\circ}\text{C}; V_{DS} = 30\text{ V}$

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



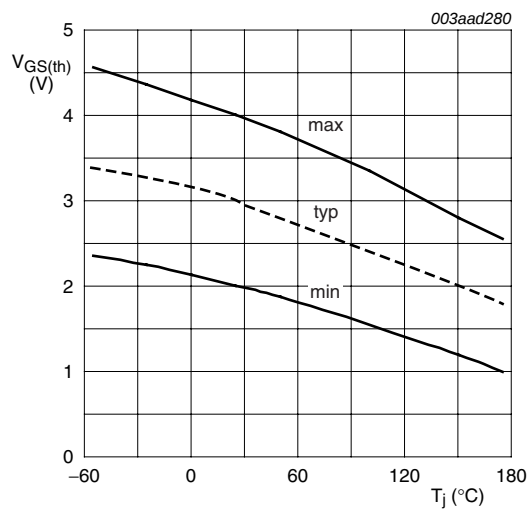
$V_{DS} = 30\text{ V}$

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



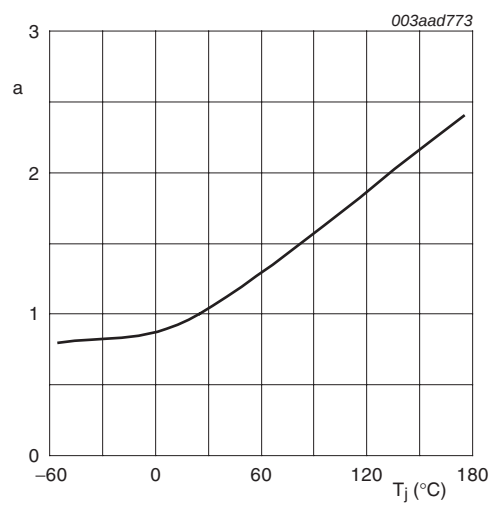
$T_j = 25\text{ }^{\circ}\text{C}; V_{DS} = 5\text{ V}$

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



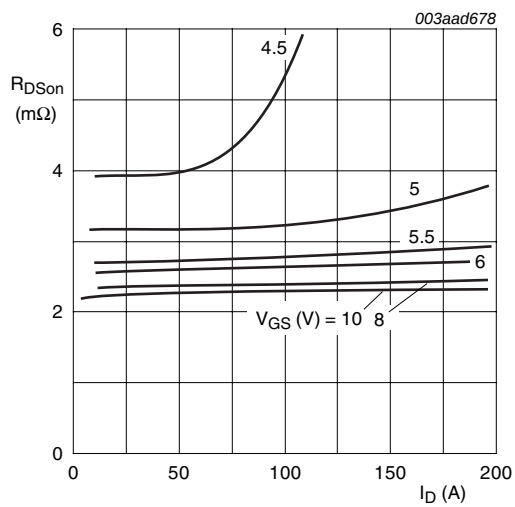
$I_D = 1\text{ mA}; V_{DS} = V_{GS}$

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



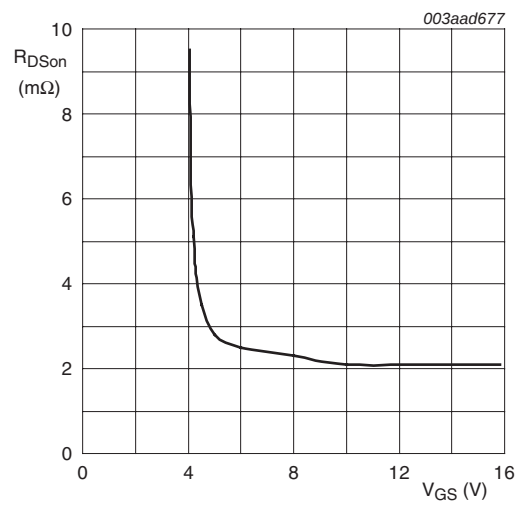
$$a = \frac{R_{DS(on)}}{R_{DS(on)(25^\circ\text{C})}}$$

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



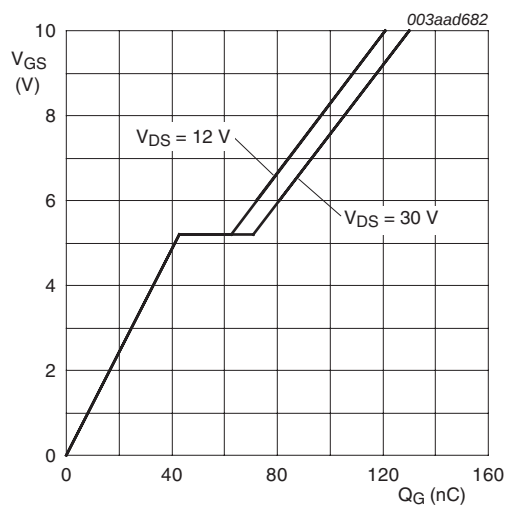
$T_j = 25^\circ\text{C}; t_p = 300\text{ }\mu\text{s}$

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



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

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



$T_j = 25\text{ }^{\circ}\text{C}; I_D = 80\text{ A}$

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

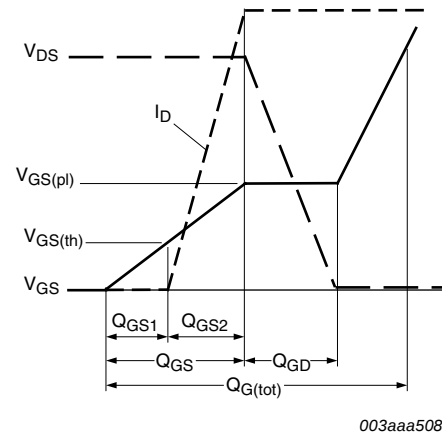
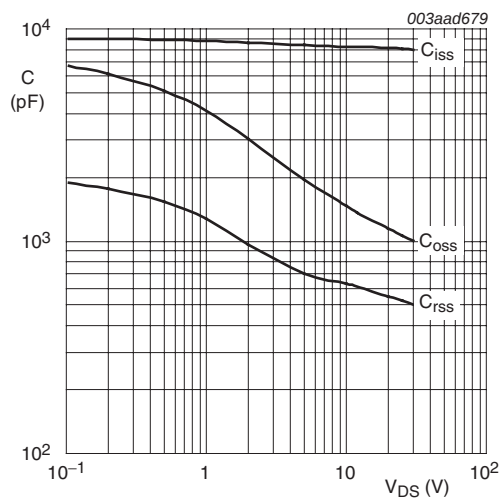
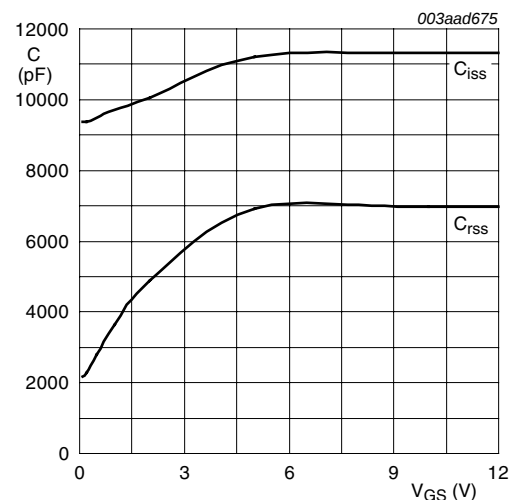


Fig 14. Gate charge waveform definitions



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

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



$f = 1\text{ MHz}$

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

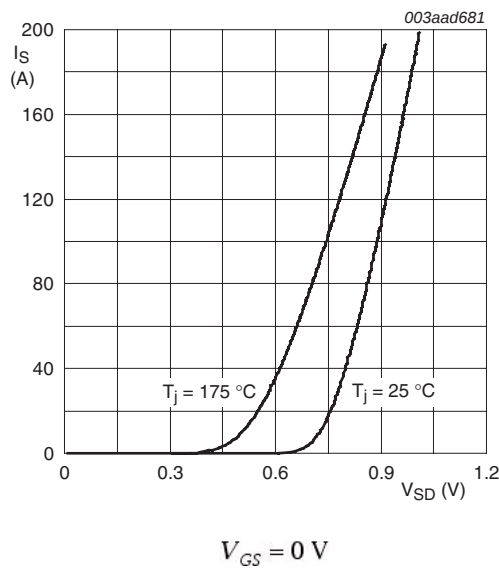


Fig 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB SOT78

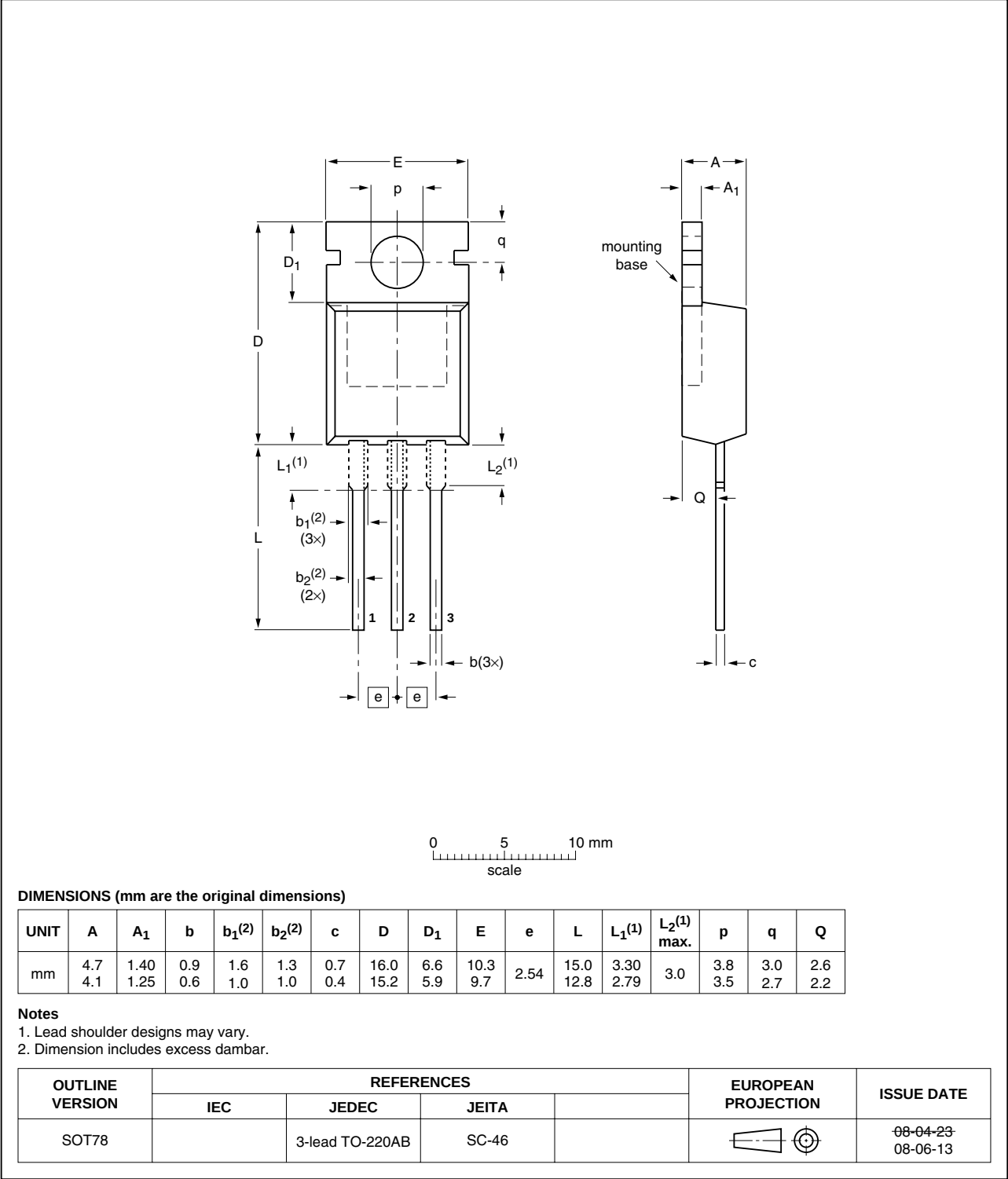


Fig 18. Package outline SOT78 (TO-220AB)

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".

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105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

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