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Kind regards,

Team Nexperia

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

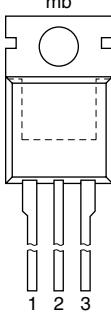
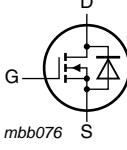
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25 \text{ }^\circ\text{C}; T_j \leq 175 \text{ }^\circ\text{C}$	-	-	60	V
I_D	drain current	$T_{mb} = 25 \text{ }^\circ\text{C}; V_{GS} = 10 \text{ V};$ see Figure 1	[1]	-	-	100 A
P_{tot}	total power dissipation	$T_{mb} = 25 \text{ }^\circ\text{C}$; see Figure 2	-	-	306	W
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 11 ; see Figure 12	-	2.4	3	mΩ
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	$V_{GS} = 10 \text{ V}; T_{j(init)} = 25 \text{ }^\circ\text{C};$ $I_D = 100 \text{ A}; V_{sup} \leq 60 \text{ V};$ $R_{GS} = 50 \Omega$; 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		Version
	Name	Description	
PSMN3R0-60PS	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

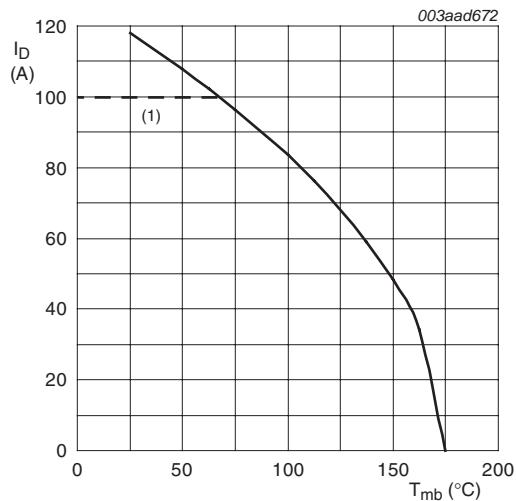
4. Limiting values

Table 4. Limiting values

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

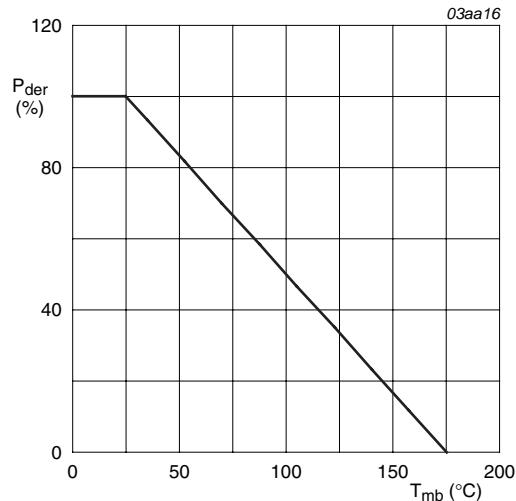
Symbol	Parameter	Conditions	Min	Max	Unit	
V_{DS}	drain-source voltage	$T_j \geq 25^\circ\text{C}$; $T_j \leq 175^\circ\text{C}$	-	60	V	
V_{DGR}	drain-gate voltage	$T_j \geq 25^\circ\text{C}$; $T_j \leq 175^\circ\text{C}$; $R_{GS} = 20\text{ k}\Omega$	-	60	V	
V_{GS}	gate-source voltage		-20	20	V	
I_D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

[1] Continuous current is limited by package.



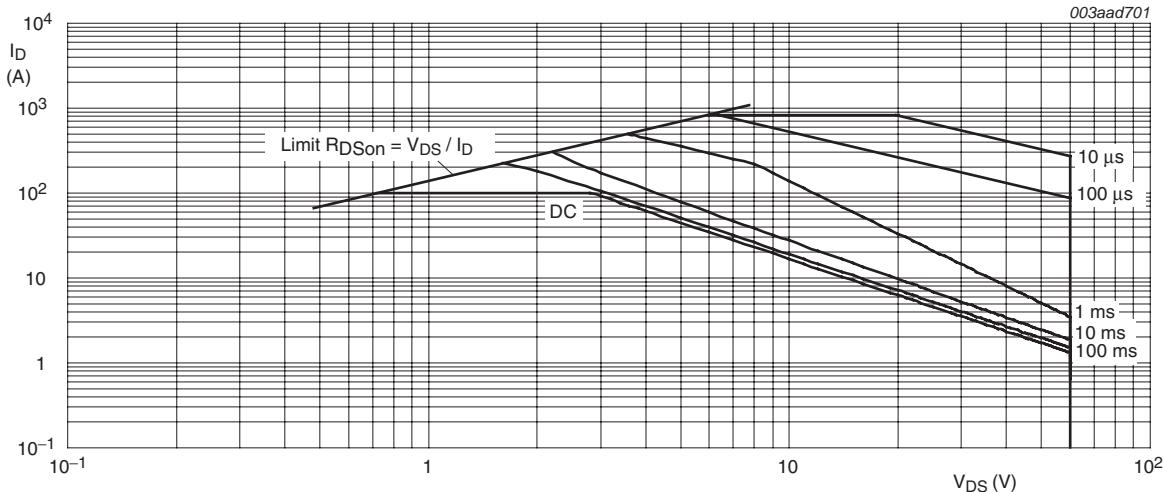
$V_{GS} \geq 10$ V(1) Capped at 100 A due to package

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



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

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
$R_{th(j\text{-}mb)}$	thermal resistance from junction to mounting base	see Figure 4	-	0.3	0.49	K/W

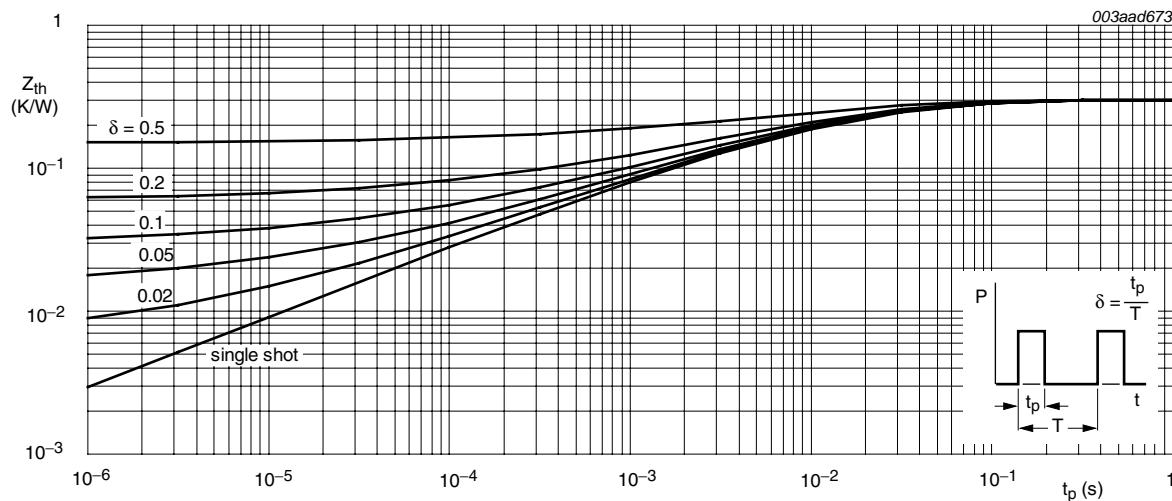
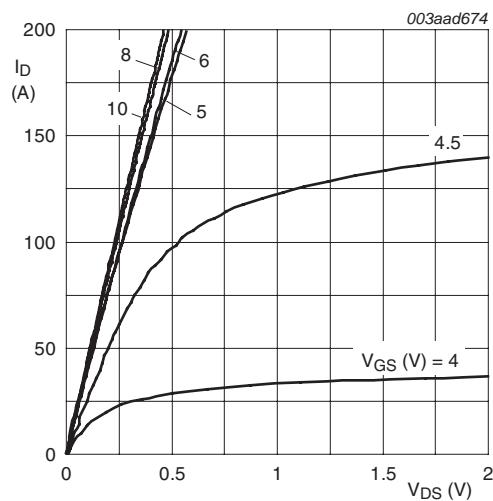


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

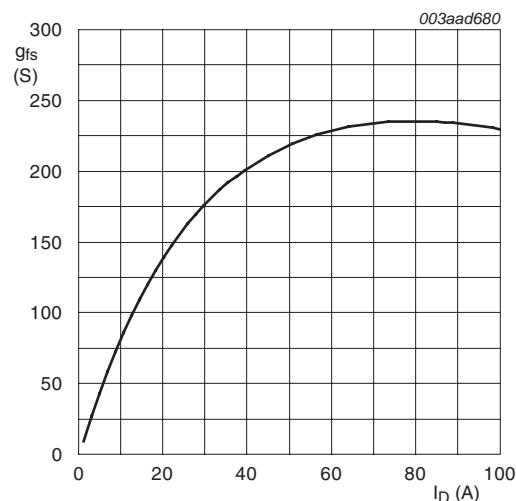
Table 6. Characteristics

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



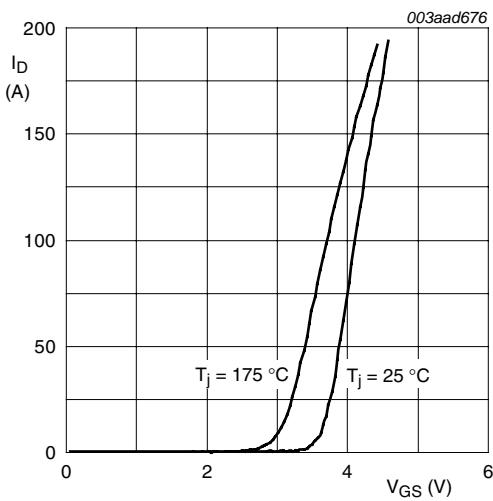
$T_j = 25^\circ\text{C}$; $t_p = 300\mu\text{s}$

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



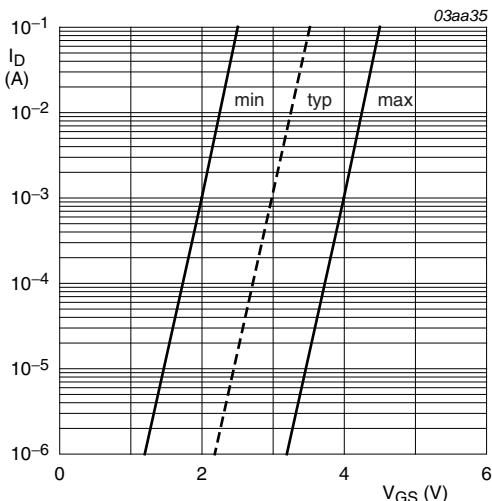
$T_j = 25^\circ\text{C}$; $V_{DS} = 30\text{V}$

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



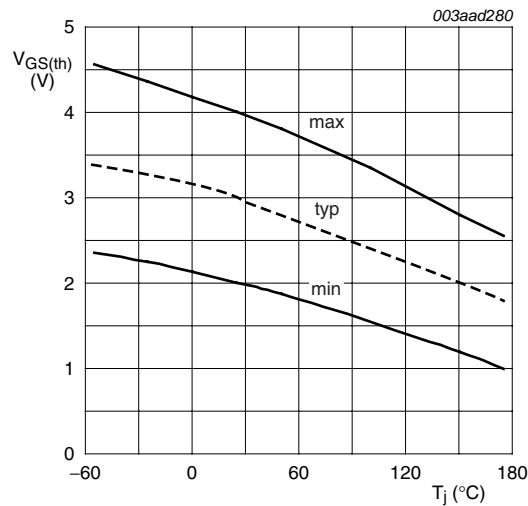
$V_{DS} = 30\text{V}$

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



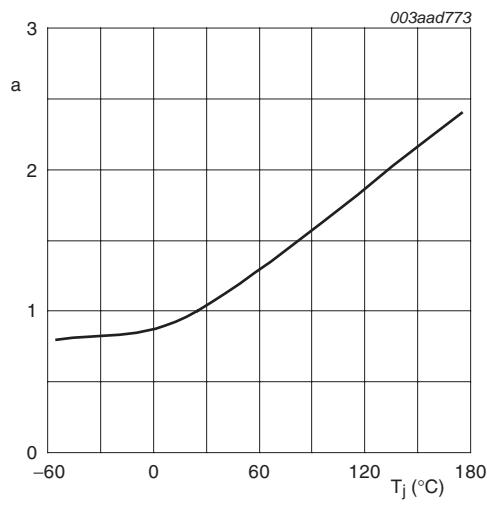
$T_j = 25^\circ\text{C}$; $V_{DS} = 5\text{V}$

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



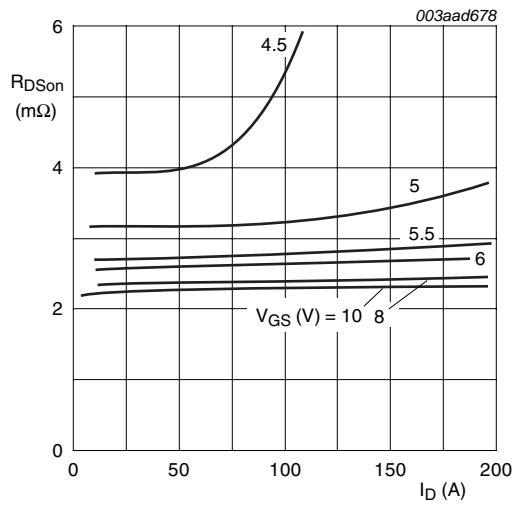
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

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



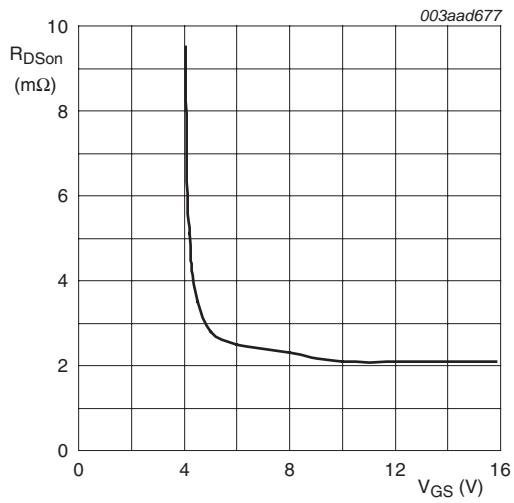
$$a = \frac{R_{DSon}}{R_{DSon}(25 \text{ } ^\circ\text{C})}$$

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



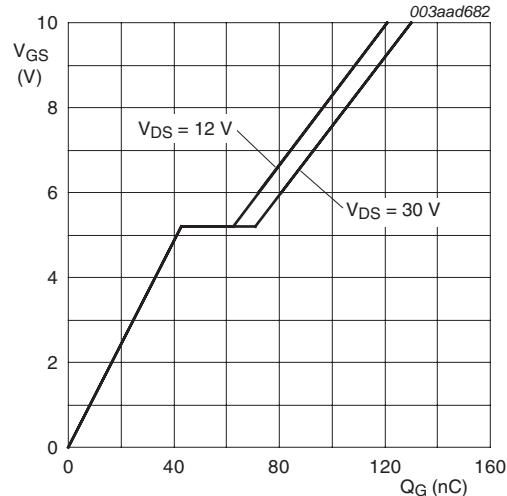
$T_j = 25 \text{ } ^\circ\text{C}; t_p = 300 \mu\text{s}$

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



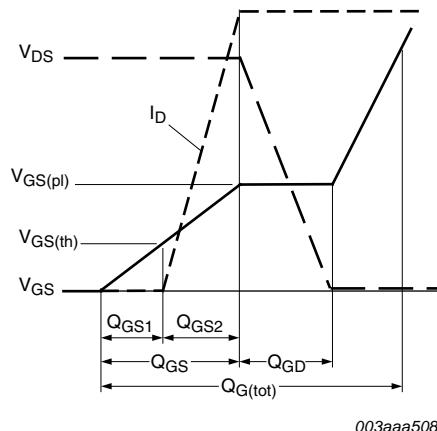
$T_j = 25 \text{ } ^\circ\text{C}; I_D = 25 \text{ A}$

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



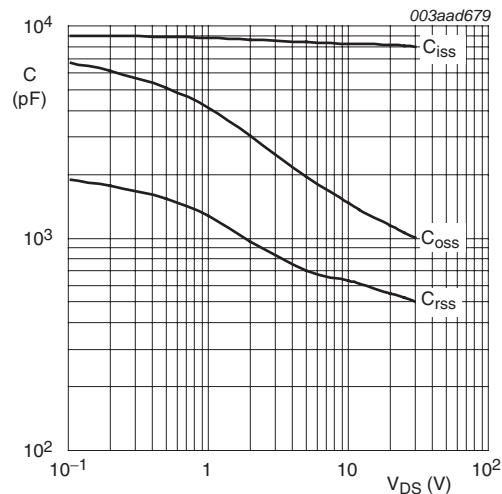
$T_j = 25^\circ\text{C}$; $I_D = 80 \text{ A}$

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



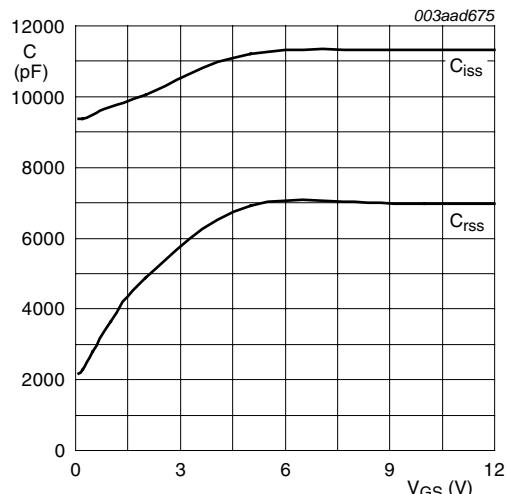
003aaa508

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

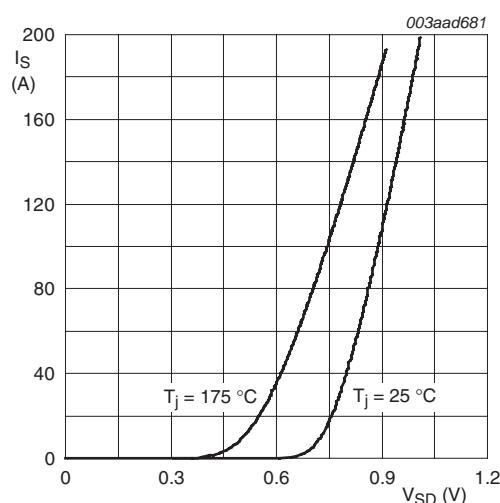
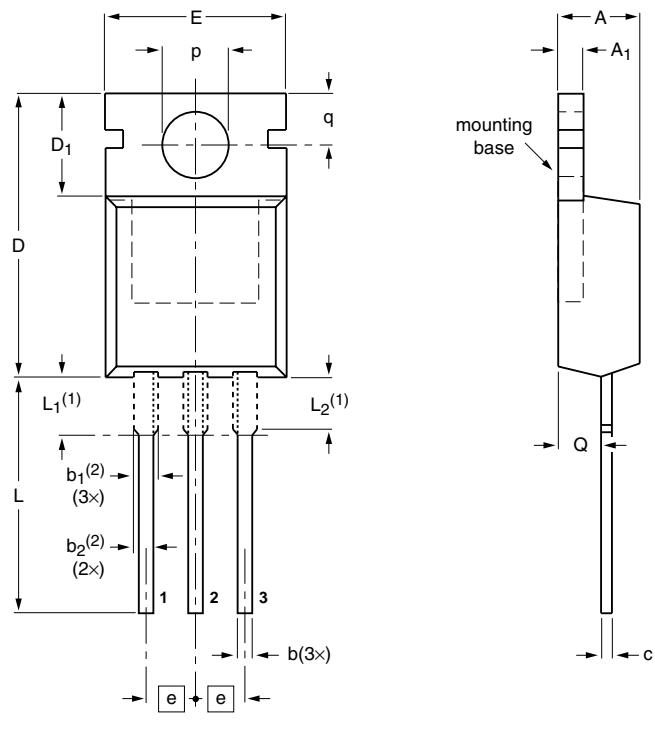


Fig 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

7. Package outline

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

SOT78



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	1.40	0.9	1.6	1.3	0.7	16.0	6.6	10.3	2.54	15.0	3.30	3.0	3.8	3.0	2.6
	4.1	1.25	0.6	1.0	1.0	0.4	15.2	5.9	9.7		12.8	2.79	3.0	3.5	2.7	2.2

Notes

1. Lead shoulder designs may vary.
2. Dimension includes excess dambar.

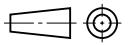
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			08-04-23 08-06-13

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".

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