PSMN8R0-40PS

N-channel 40 V 7.6 mΩ standard level MOSFET

Rev. 02 — 25 June 2009 Product data sheet

1. Product profile

1.1 General description

Standard level N-channel MOSFET in 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 convertors
- Load switching
- Motor control
- Server power supplies

1.4 Quick reference data

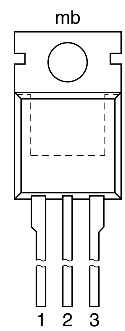
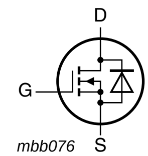
Table 1. Quick reference

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C		-	-	40	V
I_D	drain current	$T_{mb} = 25$ °C; $V_{GS} = 10$ V; see Figure 1		-	-	77	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; see Figure 2		-	-	86	W
Dynamic characteristics							
Q_{GD}	gate-drain charge	$V_{GS} = 10$ V; $I_D = 25$ A; $V_{DS} = 20$ V; see Figure 14; see Figure 15		-	3.8	-	nC
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10$ V; $I_D = 25$ A; $T_j = 25$ °C; see Figure 13	[1]	-	6.2	7.6	mΩ

[1] Measured 3 mm from 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

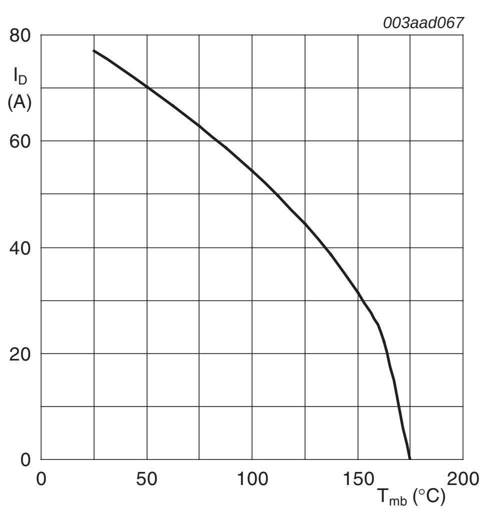
Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN8R0-40PS	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

4. Limiting values

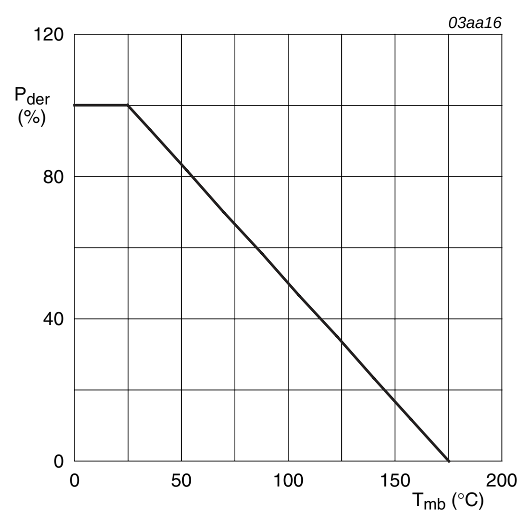
Table 4. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C	-	40	V
V_{DGR}	drain-gate voltage	$T_j \geq 25$ °C; $T_j \leq 175$ °C; $R_{GS} = 20$ kΩ	-	40	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10$ V; $T_{mb} = 100$ °C; see Figure 1	-	55	A
		$V_{GS} = 10$ V; $T_{mb} = 25$ °C; see Figure 1	-	77	A
I_{DM}	peak drain current	$t_p \leq 10$ µs; pulsed; $T_{mb} = 25$ °C; see Figure 3	-	309	A
P_{tot}	total power dissipation	$T_{mb} = 25$ °C; see Figure 2	-	86	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	-	77	A
I_{SM}	peak source current	$t_p \leq 10$ µs; pulsed; $T_{mb} = 25$ °C	-	309	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10$ V; $T_{j(init)} = 25$ °C; $I_D = 77$ A; $V_{sup} \leq 40$ V; unclamped; $R_{GS} = 50$ Ω	-	43	mJ



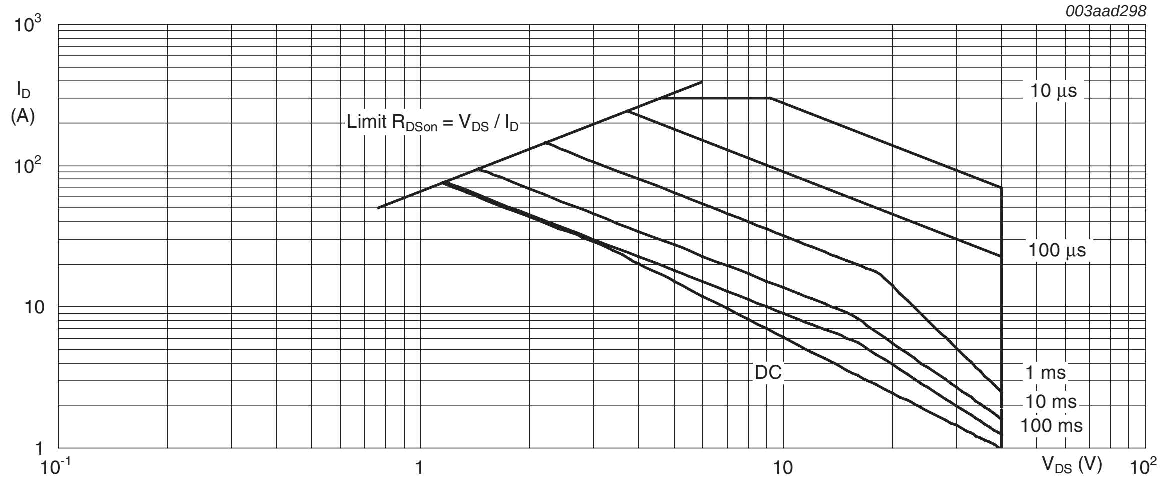
$$V_{GS} \geq 10\,V$$

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



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

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



$T_{mb} = 25\,°C; I_{DM}$ is single pulse
(1) 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	-	1.2	1.74	K/W

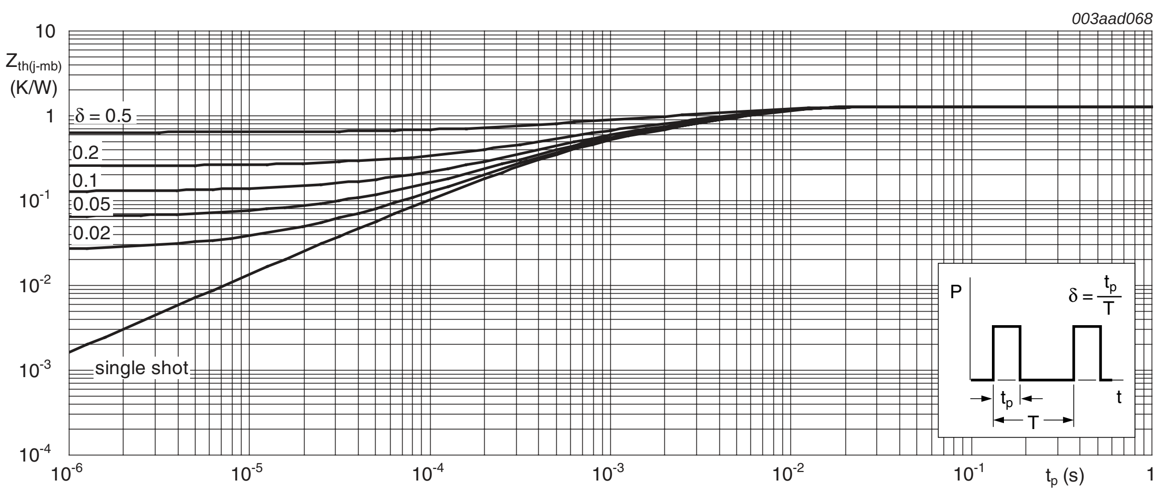


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

6. Characteristics

Table 6. Characteristics

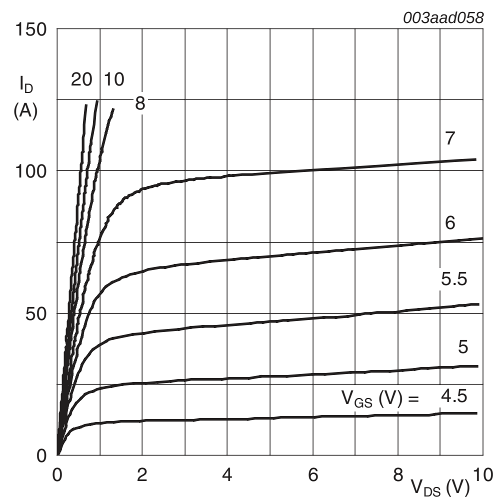
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V; T_j = -55 °C		36	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C		40	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; see Figure 11; see Figure 12		-	-	4.6	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 175 °C; see Figure 11; see Figure 12		1	-	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; see Figure 11; see Figure 12		2	3	4	V
I_{DSS}	drain leakage current	V_{DS} = 40 V; V_{GS} = 0 V; T_j = 25 °C		-	-	1.5	µA
		V_{DS} = 40 V; V_{GS} = 0 V; T_j = 125 °C		-	-	30	µA
I_{GSS}	gate leakage current	V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 °C		-	-	100	nA
		V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 °C		-	-	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 100 °C; see Figure 13		-	-	11	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; see Figure 13	[2]	-	6.2	7.6	mΩ
R_G	internal gate resistance (AC)	f = 1 MHz		-	1.1	-	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 0 A; V_{DS} = 0 V; V_{GS} = 10 V		-	17	-	nC
		I_D = 25 A; V_{DS} = 20 V; V_{GS} = 10 V; see Figure 14; see Figure 15		-	21	-	nC
Q_{GS}	gate-source charge	I_D = 25 A; V_{DS} = 20 V; V_{GS} = 10 V; see Figure 14; see Figure 15		-	7.2	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge	I_D = 25 A; V_{DS} = 20 V; V_{GS} = 10 V; see Figure 14		-	3.6	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge			-	3.6	-	nC
Q_{GD}	gate-drain charge	I_D = 25 A; V_{DS} = 20 V; V_{GS} = 10 V; see Figure 14; see Figure 15		-	3.8	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	I_D = 25 A; V_{DS} = 20 V; see Figure 14		-	4.8	-	V
C_{iss}	input capacitance	V_{DS} = 12 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; see Figure 16		-	1262	-	pF
C_{oss}	output capacitance			-	327	-	pF
C_{rss}	reverse transfer capacitance			-	160	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 12 V; R_L = 0.5 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 4.7 Ω		-	12	-	ns
t_r	rise time			-	4.7	-	ns
$t_{d(off)}$	turn-off delay time			-	21	-	ns
t_f	fall time			-	4.7	-	ns

Table 6. Characteristics *…continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; T_j = 25 °C; see Figure 17	-	0.85	1.2	V
t_{rr}	reverse recovery time	I_S = 50 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 20 V	-	30	-	ns
Q_r	recovered charge	I_S = 50 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 20 V; T_j = 25 °C	-	18	-	nC

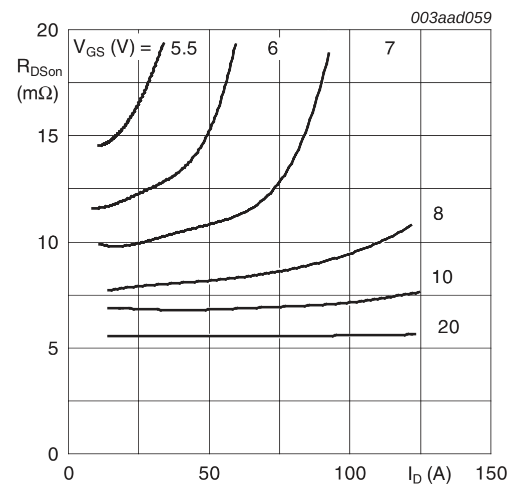
[1] Tested to JEDEC standards where applicable.

[2] Measured 3 mm from package.



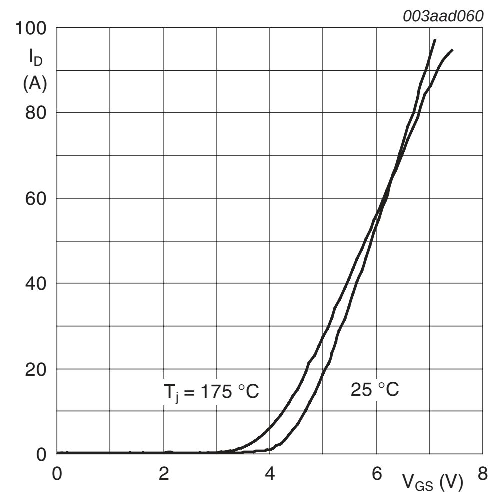
$T_j = 25\,°C; t_p = 300 \mu s$

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



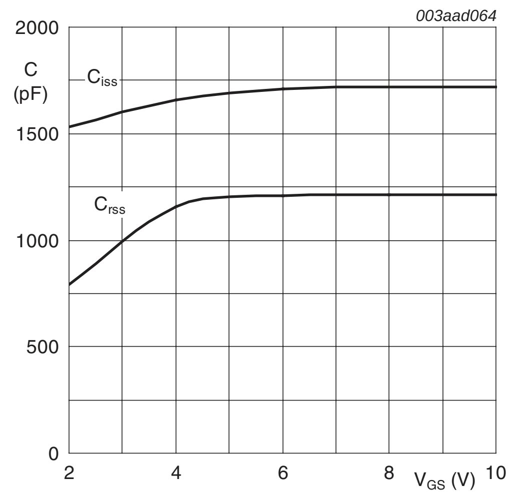
$T_j = 25\,°C; t_p = 300 \mu s$

Fig 6. Drain-source on-state resistance as a function of drain current; typical values



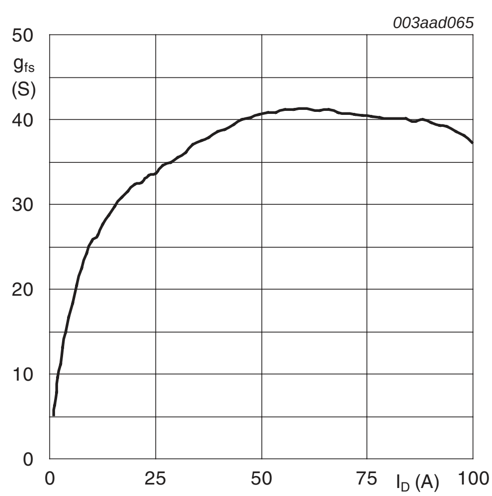
$V_{DS} = 15V$

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



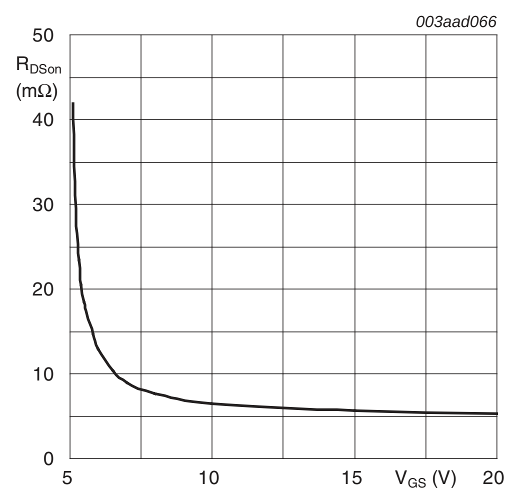
$V_{DS} = 0V; f = 1MHz$

Fig 8. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



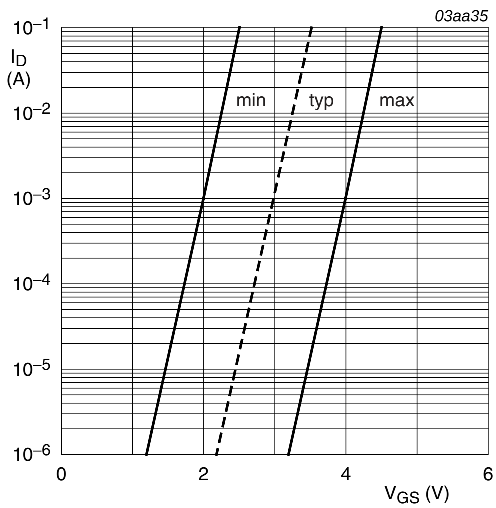
$T_j = 25°C; V_{DS} = 15V$

Fig 9. Forward transconductance as a function of drain current; typical values



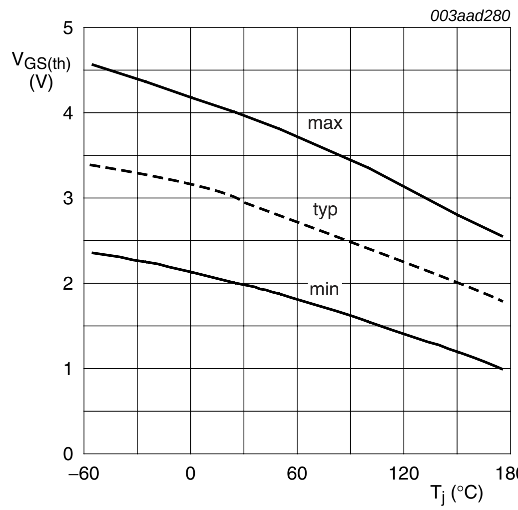
$T_j = 25°C; I_D = 25A$

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



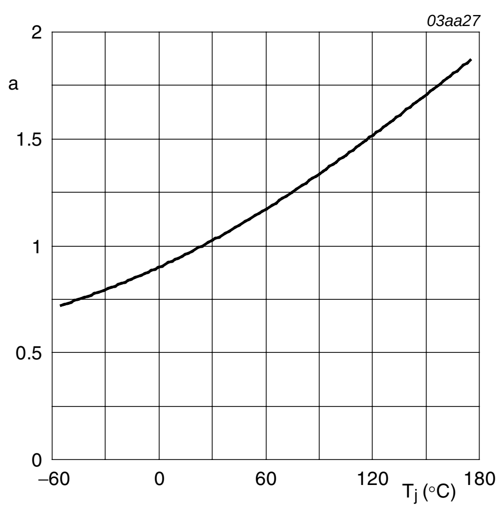
$T_j = 25\,°C; V_{DS} = 5V$

Fig 11. Sub-threshold drain current as a function of gate-source voltage



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

Fig 12. Gate-source threshold voltage as a function of junction temperature



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

Fig 13. Normalized drain-source on-state resistance factor as a function of junction temperature

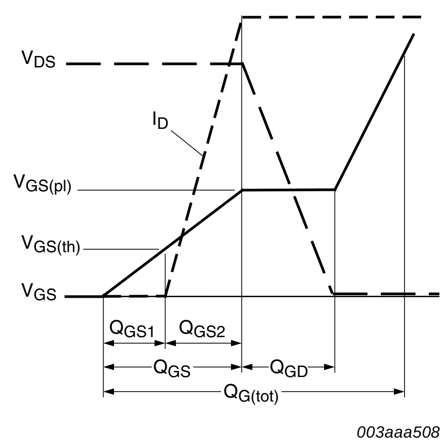
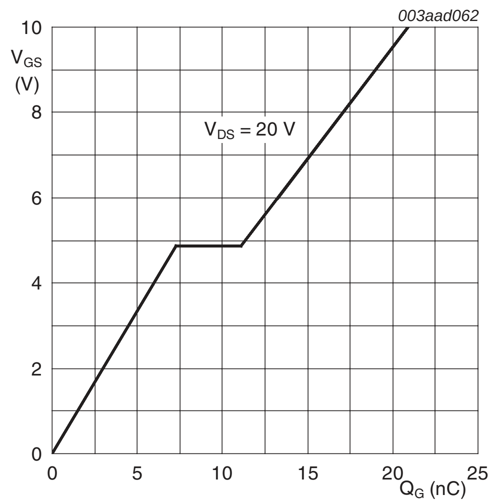
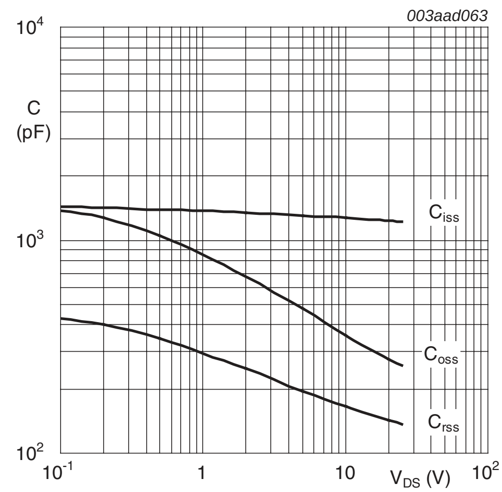


Fig 14. Gate charge waveform definitions



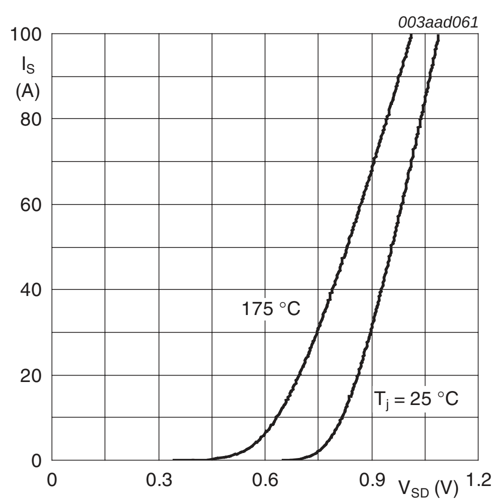
$T_j = 25\,°C; I_D = 25A$

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



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

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

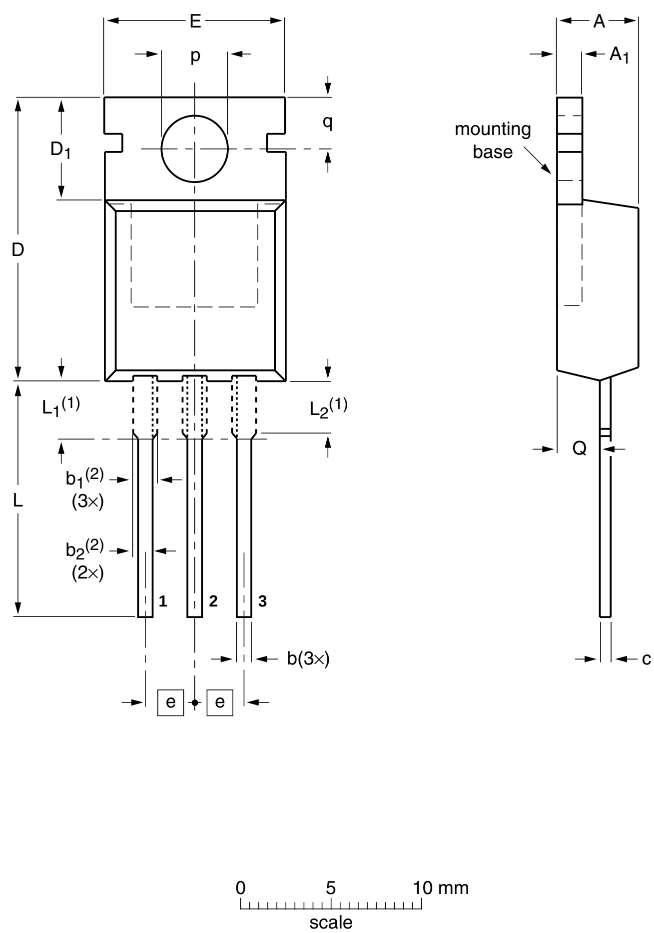


$V_{GS} = 0V$

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
PSMN8R0-40PS_2	20090625	Product data sheet	-	PSMN8R0-40PS_1
Modifications:	• Status changed from objective to product			
PSMN8R0-40PS_1	20090511	Objective 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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Date of release: 25 June 2009