

PSMN050-80PS

N-channel 80 V 50 mΩ standard level MOSFET

Rev. 01 — 10 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
- Repetitive avalanche rated

1.3 Applications

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

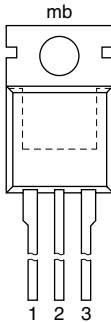
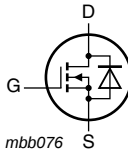
1.4 Quick reference data

Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_D	drain current	$T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; see Figure 1	-	-	22	A
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $V_{DS} = 40\text{ V}$; see Figure 14 ; see Figure 15	-	2.3	-	nC

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate		
2	D	drain		
3	S	source		
			SOT78 (TO-220AB; SC-46)	

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PSMN050-80PS	TO-220AB; SC-46	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	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	80	V
V_{DGR}	drain-gate voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	80	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	-	16	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 1	-	22	A
I_{DM}	peak drain current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$	-	88	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	56	W
T_{stg}	storage temperature		-55	175	°C
T_j	junction temperature		-55	175	°C
Source-drain diode					
I_S	source current	$T_{mb} = 25\text{ °C}$	-	22	A
I_{SM}	peak source current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$	-	88	A
Avalanche ruggedness					
$E_{DS(AL)R}$	repetitive drain-source avalanche energy	see Figure 3	[1] [2] [3]	-	J
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 22\text{ A}$; $V_{sup} \leq 80\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped	-	18	mJ

[1] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.

[2] Repetitive avalanche rating limited by average junction temperature of 170 °C.

[3] Refer to application note AN10273 for further information.

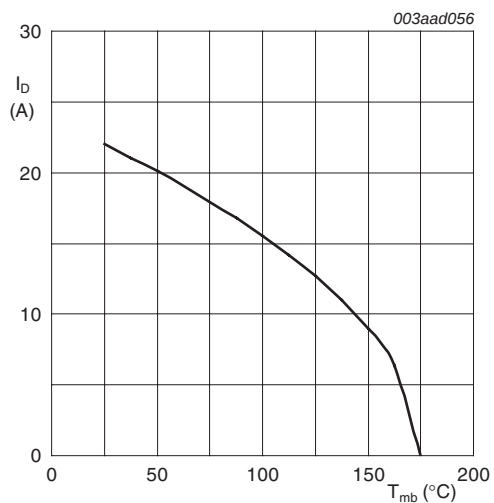


Fig 1. Continuous drain current as a function of mounting base temperature

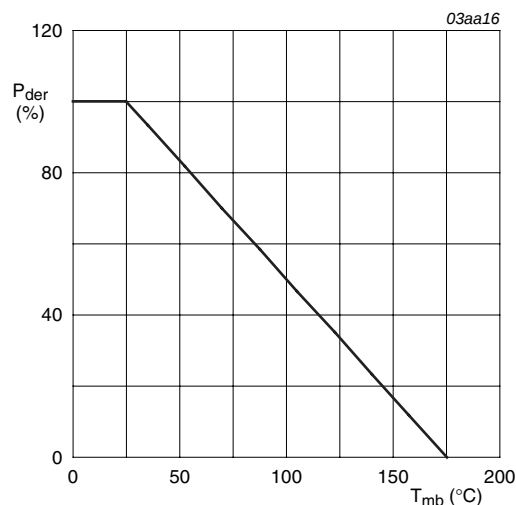
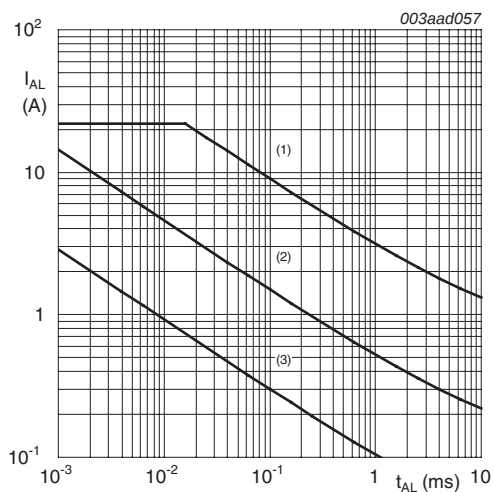


Fig 2. Normalized total power dissipation as a function of mounting base temperature



- (1) Single-pulse; $T_j = 25\text{ °C}$.
- (2) Single-pulse; $T_j = 150\text{ °C}$.
- (3) Repetitive.

Fig 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time

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	-	-	2.7	K/W

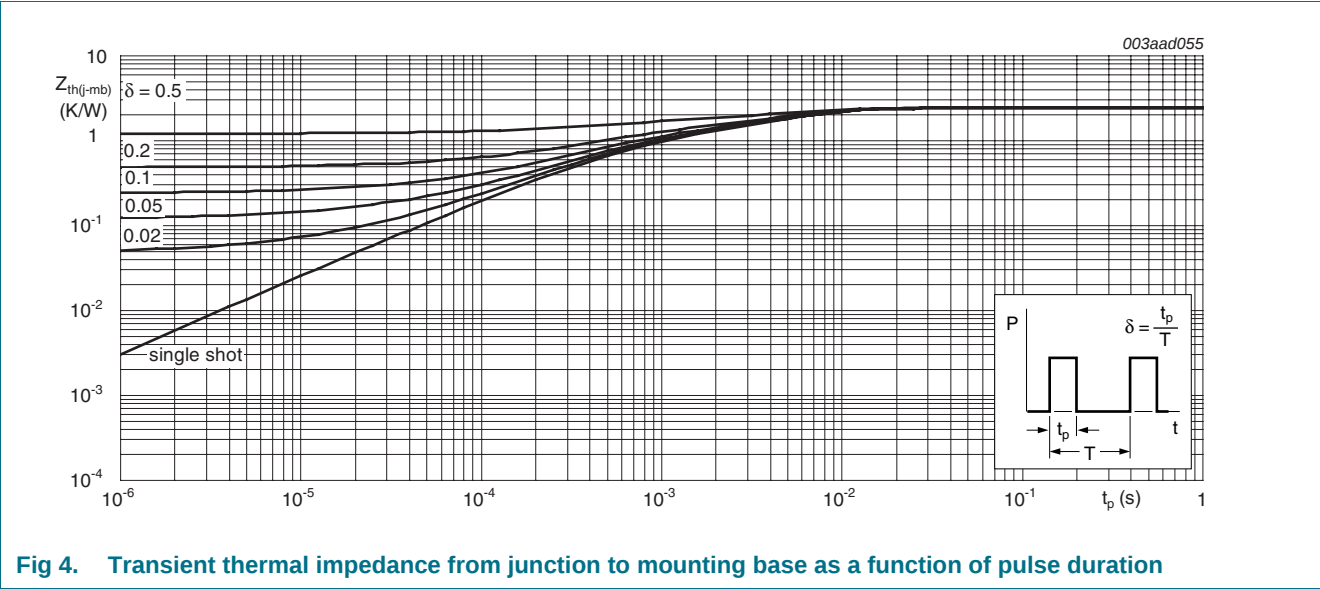


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

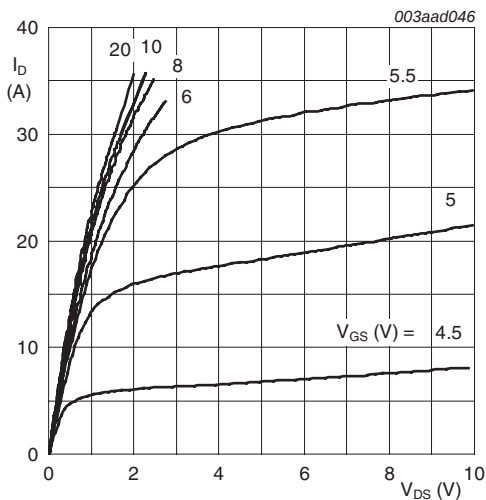
Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A$; $V_{GS} = 0 V$; $T_j = -55 ^\circ C$	73	-	-	V
		$I_D = 250 \mu A$; $V_{GS} = 0 V$; $T_j = 25 ^\circ C$	80	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 mA$; $V_{DS} = V_{GS}$; $T_j = 175 ^\circ C$; see Figure 11 ; see Figure 12	1	-	-	V
		$I_D = 1 mA$; $V_{DS} = V_{GS}$; $T_j = -55 ^\circ C$; see Figure 11 ; see Figure 12	-	-	4.4	V
		$I_D = 1 mA$; $V_{DS} = V_{GS}$; $T_j = 25 ^\circ C$; see Figure 11 ; see Figure 12	2	3	4	V
I_{DSS}	drain leakage current	$V_{DS} = 80 V$; $V_{GS} = 0 V$; $T_j = 25 ^\circ C$	-	-	1	μA
		$V_{DS} = 80 V$; $V_{GS} = 0 V$; $T_j = 100 ^\circ C$	-	-	100	μA
I_{GSS}	gate leakage current	$V_{GS} = -20 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$	-	-	100	nA
		$V_{GS} = 20 V$; $V_{DS} = 0 V$; $T_j = 25 ^\circ C$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 V$; $I_D = 10 A$; $T_j = 100 ^\circ C$; see Figure 13	-	-	81	mΩ
		$V_{GS} = 10 V$; $I_D = 10 A$; $T_j = 25 ^\circ C$ [2]	-	37	51	mΩ
R_G	internal gate resistance (AC)	$f = 1 MHz$	-	2	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 0 A$; $V_{DS} = 0 V$; $V_{GS} = 10 V$	-	9	-	nC
		$I_D = 25 A$; $V_{DS} = 40 V$; $V_{GS} = 10 V$; see Figure 14 ; see Figure 15	-	11	-	nC
Q_{GS}	gate-source charge	$I_D = 25 A$; $V_{DS} = 40 V$; $V_{GS} = 10 V$; see Figure 14 ; see Figure 15	-	3.8	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	1.9	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	1.9	-	nC
Q_{GD}	gate-drain charge		-	2.3	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 40 V$	-	5.2	-	V
C_{iss}	input capacitance	$V_{DS} = 12 V$; $V_{GS} = 0 V$; $f = 1 MHz$; $T_j = 25 ^\circ C$; see Figure 16	-	633	-	pF
C_{oss}	output capacitance		-	100	-	pF
C_{rss}	reverse transfer capacitance		-	50	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 12 V$; $R_L = 0.5 \Omega$; $V_{GS} = 10 V$; $R_{G(ext)} = 4.7 \Omega$	-	9.2	-	ns
t_r	rise time		-	1	-	ns
$t_{d(off)}$	turn-off delay time		-	16	-	ns
t_f	fall time		-	2.4	-	ns

Table 6. Characteristics ...continued

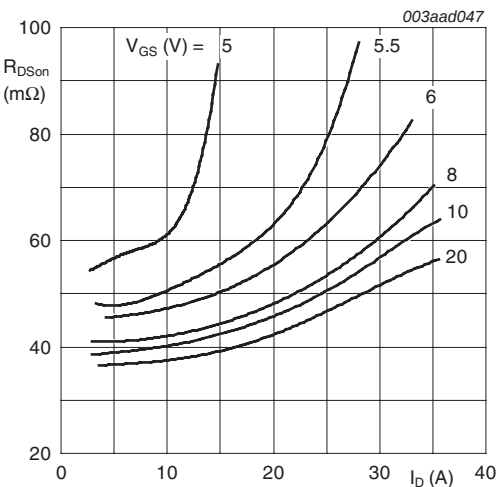
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 15\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ °C}$; see Figure 17	-	0.86	1.2	V
t_{rr}	reverse recovery time	$I_S = 50\text{ A}$; $dI_S/dt = 100\text{ A/}\mu\text{s}$; $V_{GS} = 0\text{ V}$;	-	32	-	ns
Q_r	recovered charge	$V_{DS} = 40\text{ V}$	-	28	-	nC

- [1] Tested to JEDEC standards where applicable.
[2] Measured 3 mm from package.



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

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



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

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

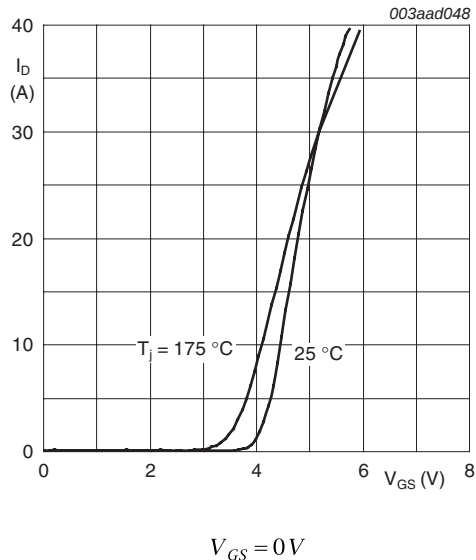


Fig 7. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

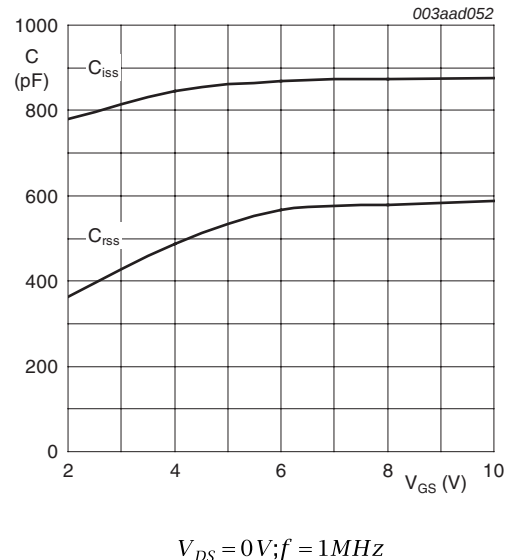


Fig 8. Input and reverse transfer capacitances as a function of gate-source voltage; typical values

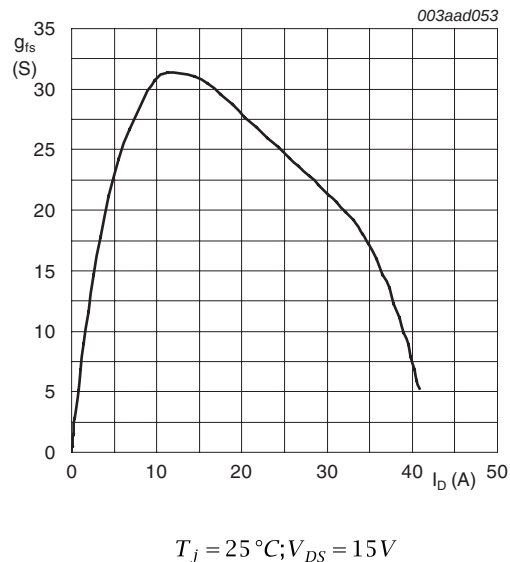


Fig 9. Forward transconductance as a function of drain current; typical values

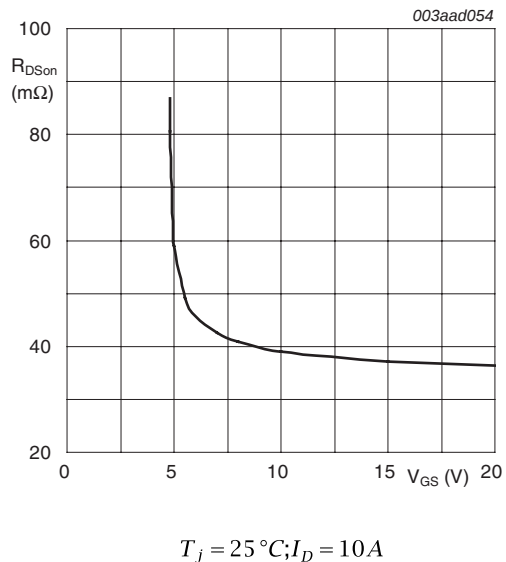
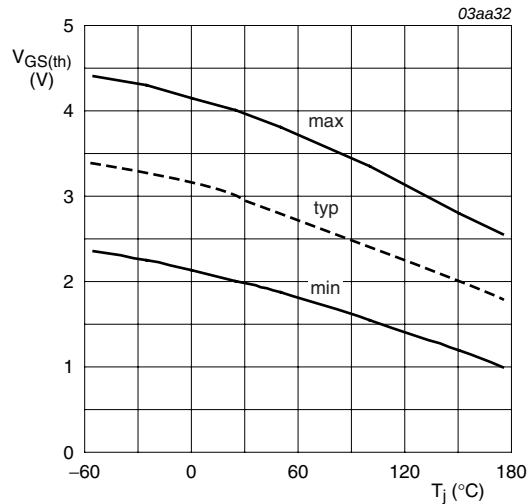
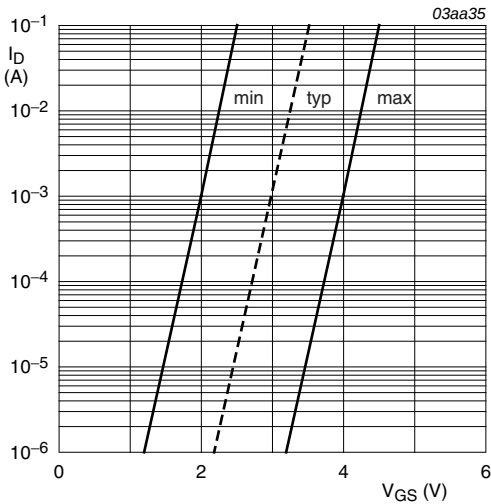


Fig 10. Drain-source on-state resistance as a function of gate-source voltage; typical values



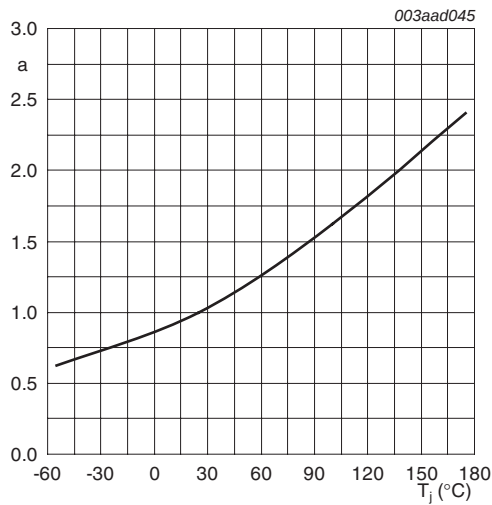
$$I_D = 1\text{ mA}; V_{DS} = V_{GS}$$

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



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

Fig 12. Sub-threshold drain current as a function of gate-source voltage



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

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

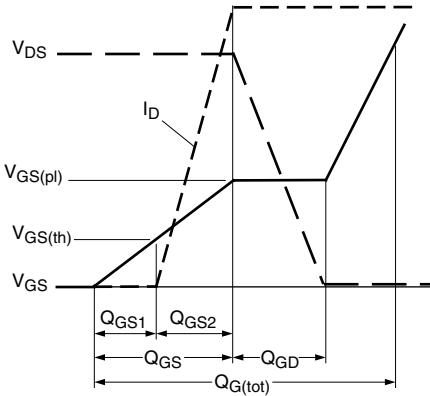
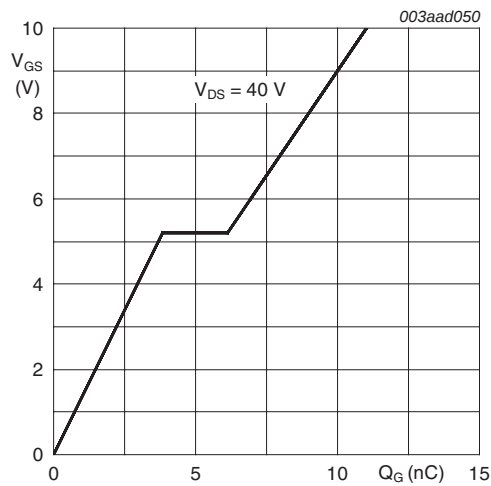
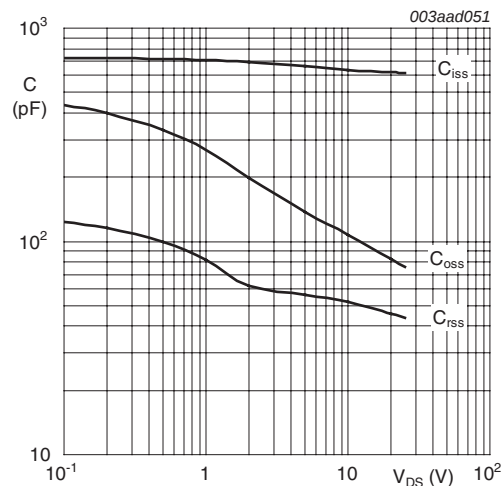


Fig 14. Gate charge waveform definitions



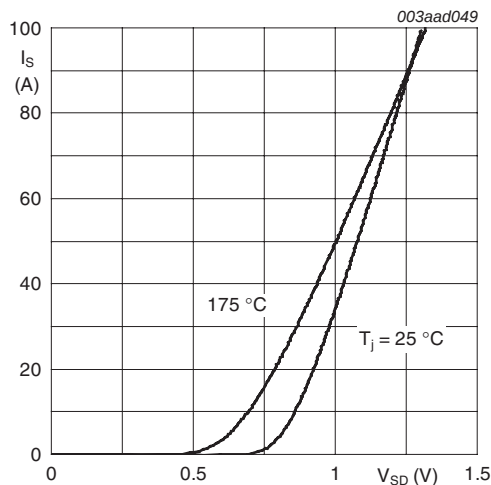
$T_j = 25\text{ }^{\circ}\text{C}; I_D = 25\text{ A}$

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



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

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



$V_{GS} = 0\text{ V}$

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

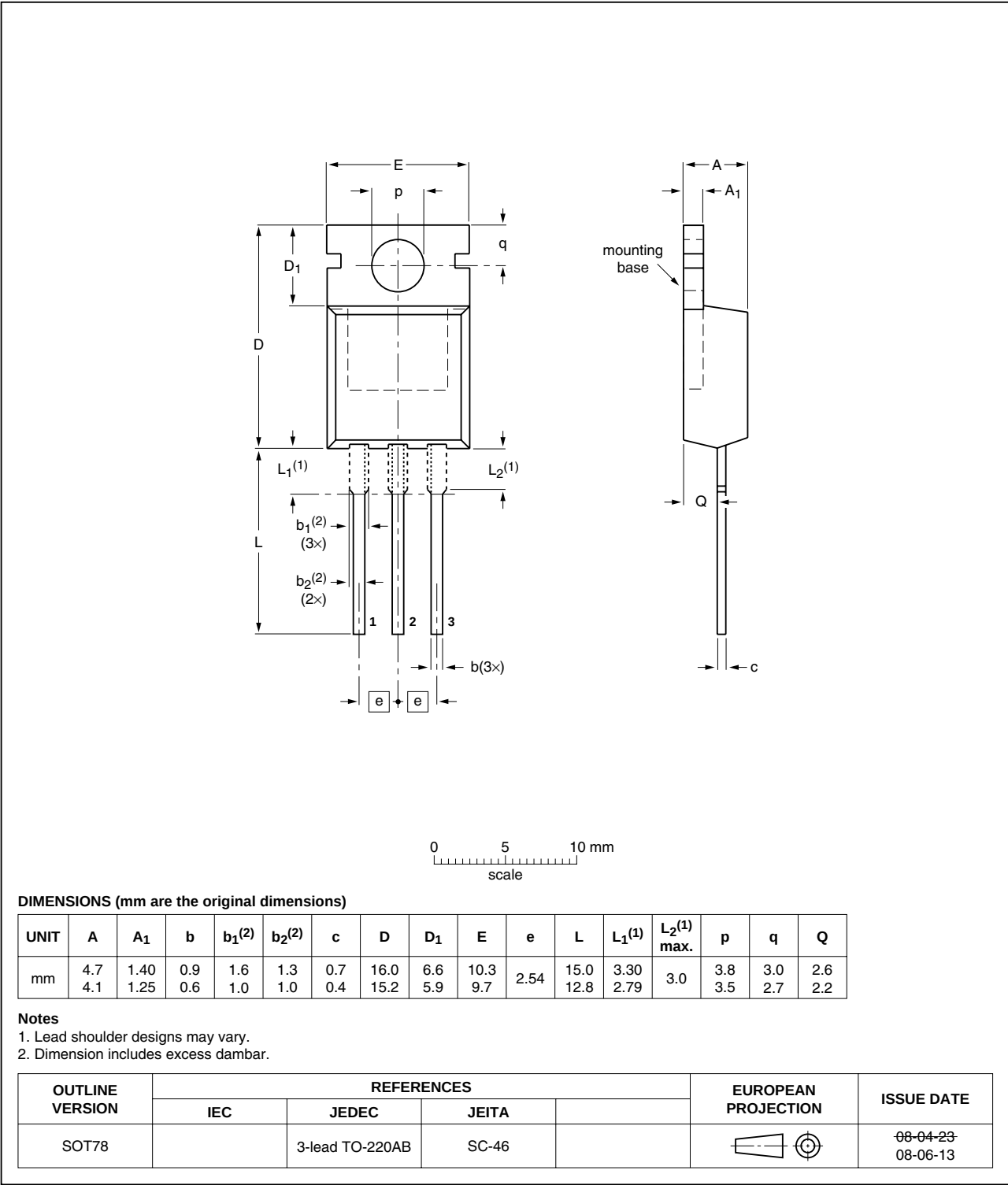


Fig 18. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN050-80PS_1	20090610	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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