



PSMN3R3-60PL

N-channel 60 V, 3.4 mΩ logic level MOSFET in SOT78

7 February 2013

Product data sheet

1. General description

Logic level N-channel MOSFET in SOT78 using TrenchMOS technology. Product design and manufacture has been optimized for use in battery operated power tools.

2. Features and benefits

- High efficiency due to low switching & conduction losses
- Robust construction for demanding applications
- Logic level gate

3. Applications

- Battery-powered tools
- Load switching
- Motor control
- Uninterruptible power supplies

4. Quick reference data

Table 1. Quick reference data

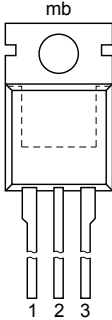
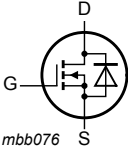
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V _{DS}	drain-source voltage	T _J ≥ 25 °C; T _J ≤ 175 °C		-	-	60	V
I _D	drain current	V _{GS} = 10 V; T _{mb} = 25 °C; Fig. 1	[1]	-	-	130	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 2		-	-	293	W
Static characteristics							
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 25 A; T _J = 25 °C; Fig. 11		-	2.7	3.4	mΩ
Dynamic characteristics							
Q _{G(tot)}	total gate charge	V _{GS} = 10 V; I _D = 25 A; V _{DS} = 48 V; Fig. 13 ; Fig. 14		-	175	-	nC
Q _{GD}	gate-drain charge			-	31	-	nC
Avalanche ruggedness							
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	I _D = 130 A; V _{sup} ≤ 60 V; R _{GS} = 50 Ω; V _{GS} = 10 V; T _{j(init)} = 25 °C; unclamped; Fig. 3		-	-	372	mJ

[1] Continuous current is limited by package.



5. Pinning information

Table 2. Pinning information

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

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN3R3-60PL	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN3R3-60PL	PSMN3R3-60PL

8. Limiting values

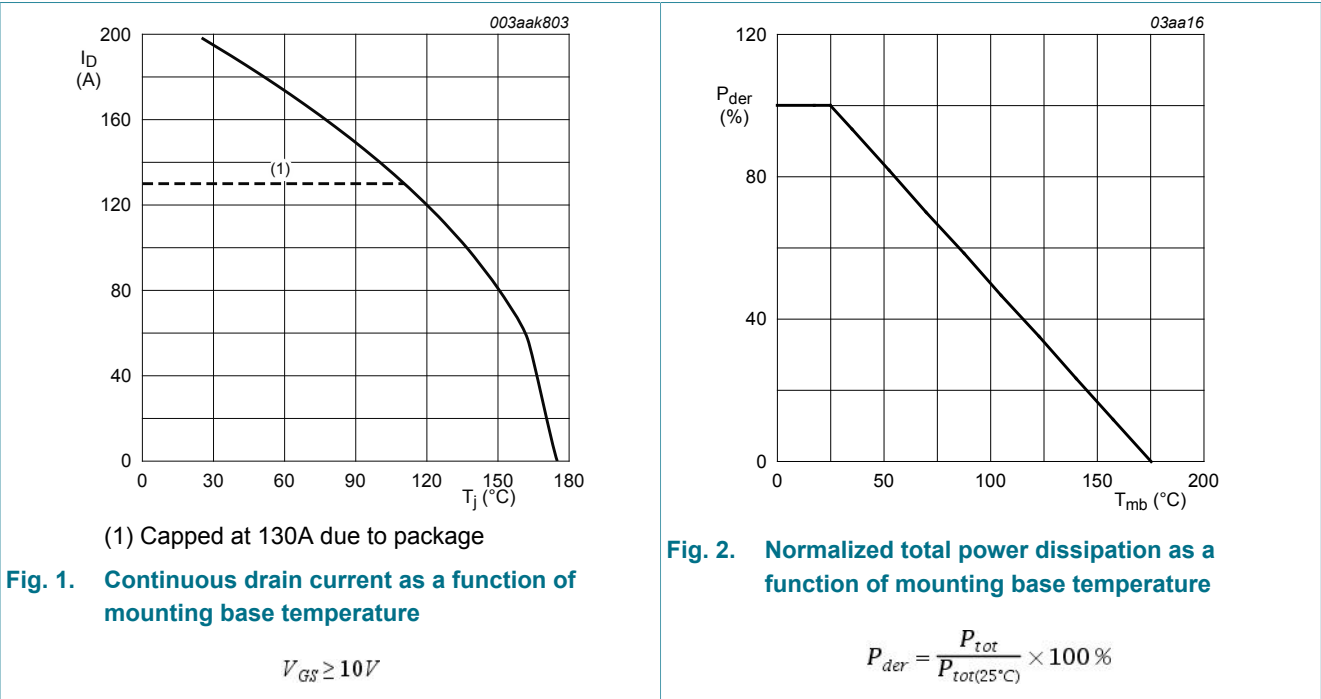
Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ }^{\circ}\text{C}$; $T_j \leq 175\text{ }^{\circ}\text{C}$		-	60	V
V_{DGR}	drain-gate voltage	$R_{GS} = 20\text{ k}\Omega$		-	60	V
V_{GS}	gate-source voltage			-20	20	V
I_D	drain current	$T_{mb} = 25\text{ }^{\circ}\text{C}$; $V_{GS} = 10\text{ V}$; Fig. 1	[1]	-	130	A
		$T_{mb} = 100\text{ }^{\circ}\text{C}$; $V_{GS} = 10\text{ V}$; Fig. 1	[1]	-	130	A
I_{DM}	peak drain current	$T_{mb} = 25\text{ }^{\circ}\text{C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$; Fig. 4		-	793	A

Symbol	Parameter	Conditions		Min	Max	Unit
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 2		-	293	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]	-	130	A
I _{SM}	peak source current	pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C		-	793	A
Avalanche ruggedness						
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	I _D = 130 A; V _{sup} ≤ 60 V; R _{GS} = 50 Ω; V _{GS} = 10 V; T _{j(init)} = 25 °C; unclamped; Fig. 3		-	372	mJ

[1] Continuous current is limited by package.



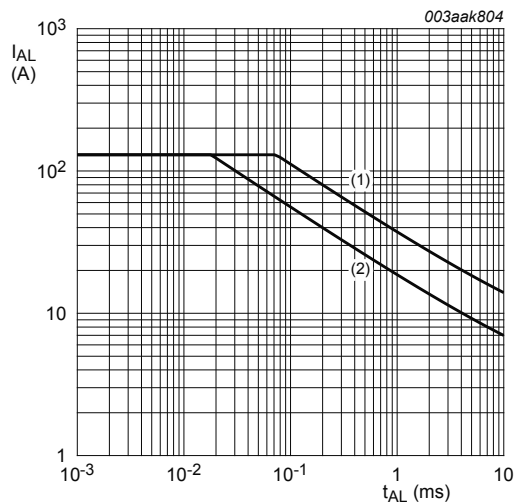


Fig. 3. Avalanche rating; avalanche current as a function of avalanche time

(1) $T_{j(jnt)} = 25^{\circ}\text{C}$; (2) $T_{j(jnt)} = 100^{\circ}\text{C}$

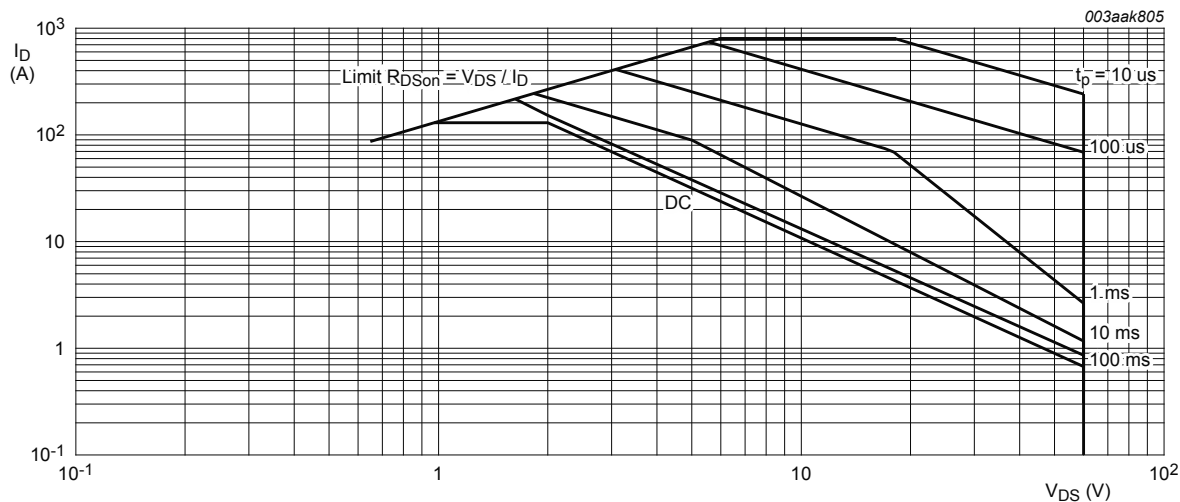


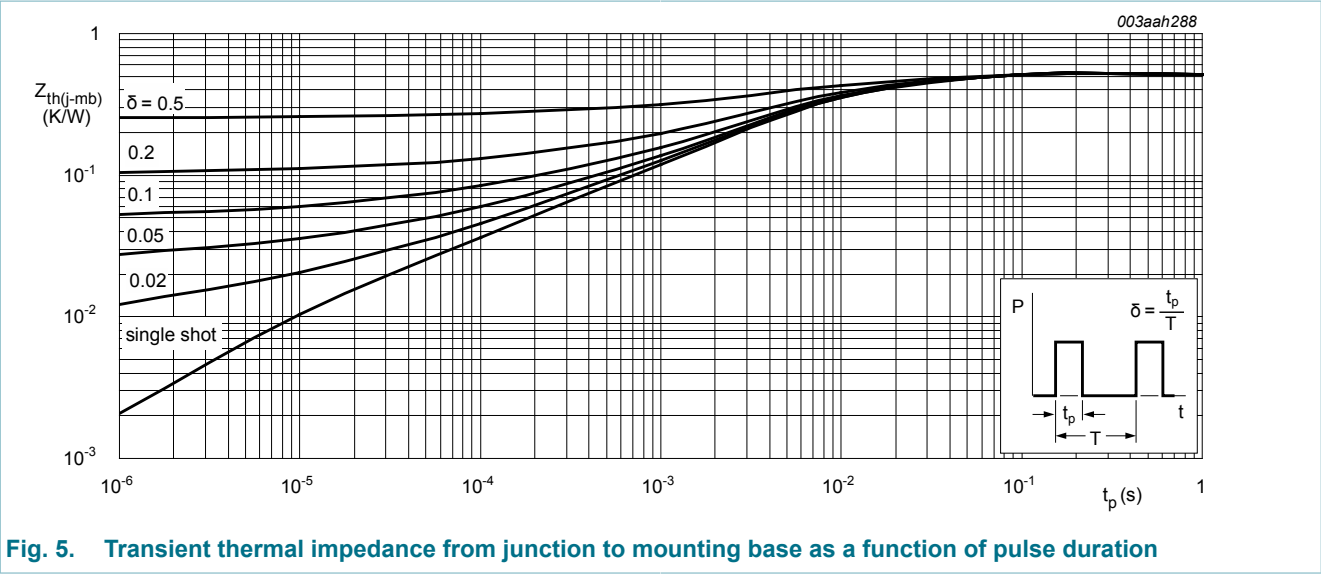
Fig. 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25^{\circ}\text{C}$; I_{DM} is a single pulse

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Fig. 5	-	0.4	0.51	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in still air	-	60	-	K/W



10. Characteristics

Table 7. 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 = 25 °C	60	-	-	V
		I _D = 250 μA; V _{GS} = 0 V; T _J = -55 °C	54	-	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 1 mA; V _{DS} = V _{GS} ; T _J = 25 °C; Fig. 9; Fig. 10	1.4	1.7	2.1	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _J = -55 °C; Fig. 9	-	-	2.45	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _J = 175 °C; Fig. 9	0.5	-	-	V
I _{DSS}	drain leakage current	V _{DS} = 60 V; V _{GS} = 0 V; T _J = 175 °C	-	-	500	μA
		V _{DS} = 60 V; V _{GS} = 0 V; T _J = 25 °C	-	0.09	1	μA
I _{GSS}	gate leakage current	V _{GS} = 16 V; V _{DS} = 0 V; T _J = 25 °C	-	2	100	nA
		V _{GS} = -16 V; V _{DS} = 0 V; T _J = 25 °C	-	2	100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 4.5 V; I _D = 25 A; T _J = 25 °C; Fig. 11	-	3	3.8	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _J = 25 °C; Fig. 11	-	2.7	3.4	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _J = 175 °C; Fig. 12; Fig. 11	-	-	7.5	mΩ
R _G	gate resistance	f = 1 MHz	0.5	1	2	Ω

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Dynamic characteristics						
$Q_{G(\text{tot})}$	total gate charge	$I_D = 25 \text{ A}$; $V_{DS} = 48 \text{ V}$; $V_{GS} = 5 \text{ V}$; Fig. 13 ; Fig. 14	-	95	-	nC
		$I_D = 25 \text{ A}$; $V_{DS} = 48 \text{ V}$; $V_{GS} = 10 \text{ V}$; Fig. 13 ; Fig. 14	-	175	-	nC
Q_{GS}	gate-source charge		-	20	-	nC
Q_{GD}	gate-drain charge		-	31	-	nC
C_{iss}	input capacitance	$V_{GS} = 0 \text{ V}$; $V_{DS} = 25 \text{ V}$; $f = 1 \text{ MHz}$;	-	10115	-	pF
C_{oss}	output capacitance	$T_j = 25^\circ\text{C}$; Fig. 15	-	822	-	pF
C_{rss}	reverse transfer capacitance		-	427	-	pF
$t_{d(\text{on})}$	turn-on delay time	$V_{DS} = 45 \text{ V}$; $R_L = 1.8 \Omega$; $V_{GS} = 5 \text{ V}$;	-	54.2	-	ns
t_r	rise time	$R_{G(\text{ext})} = 5 \Omega$	-	100	-	ns
$t_{d(\text{off})}$	turn-off delay time		-	158	-	ns
t_f	fall time		-	109	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 25 \text{ A}$; $V_{GS} = 0 \text{ V}$; $T_j = 25^\circ\text{C}$; Fig. 16	-	0.78	1.2	V
t_{rr}	reverse recovery time	$I_S = 20 \text{ A}$; $di_S/dt = -100 \text{ A}/\mu\text{s}$; $V_{GS} = 0 \text{ V}$;	-	43	-	ns
Q_r	recovered charge	$V_{DS} = 25 \text{ V}$	-	67	-	nC

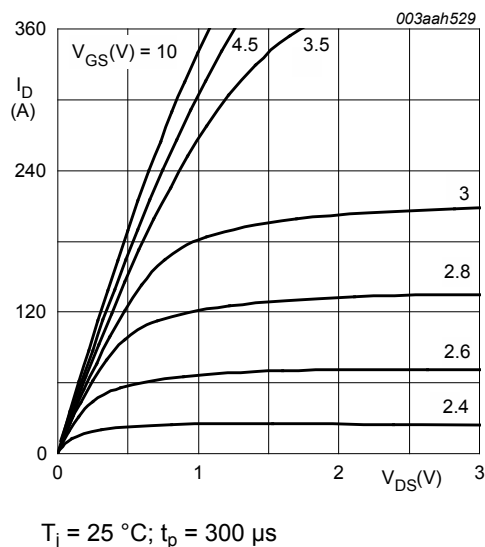


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

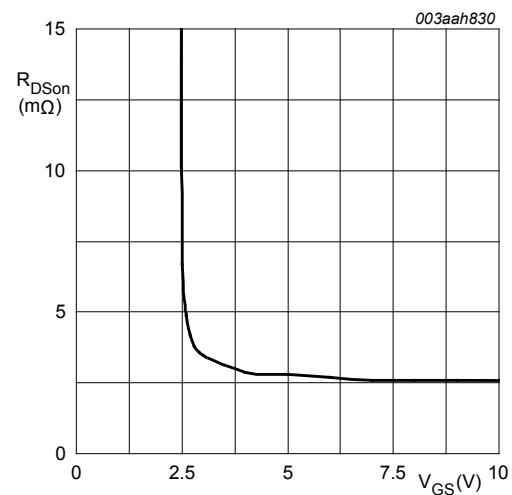


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

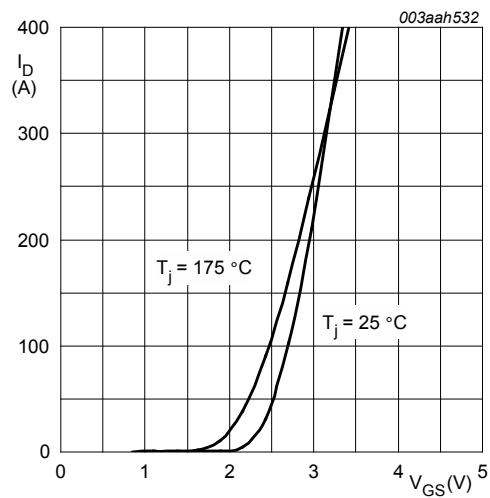


Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values

$V_{DS} = 10V$

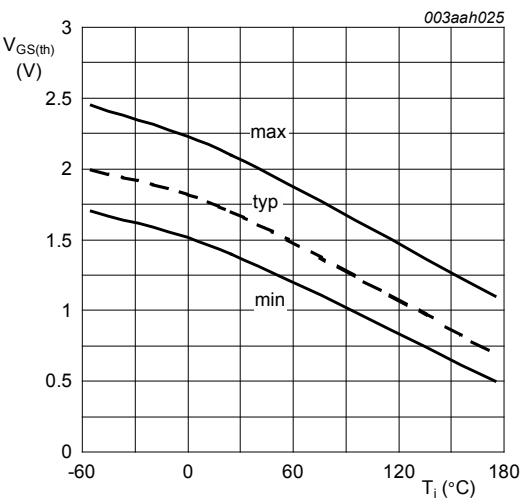


Fig. 9. Gate-source threshold voltage as a function of junction temperature

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

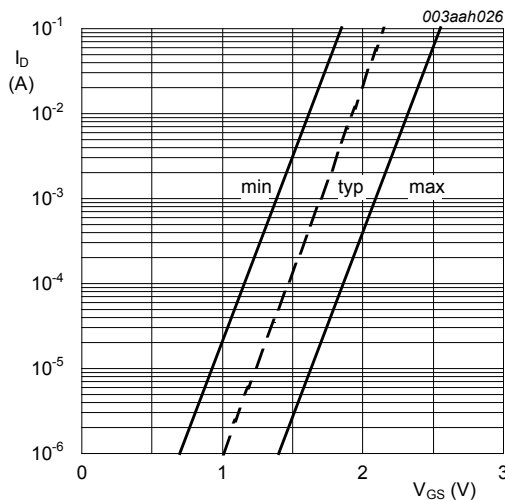


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

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

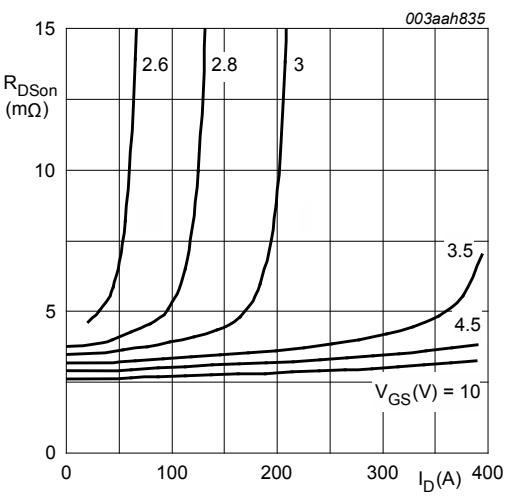


Fig. 11. Drain-source on-state resistance as a function of drain current; typical values

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

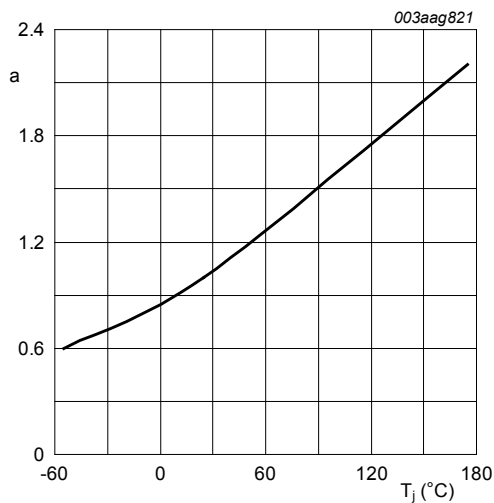


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

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

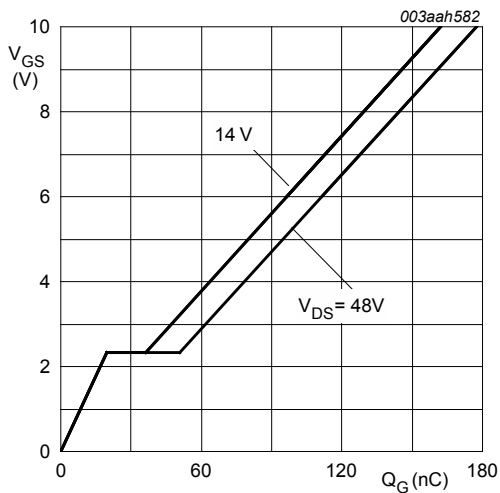


Fig. 14. Gate-source voltage as a function of gate charge; typical values

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

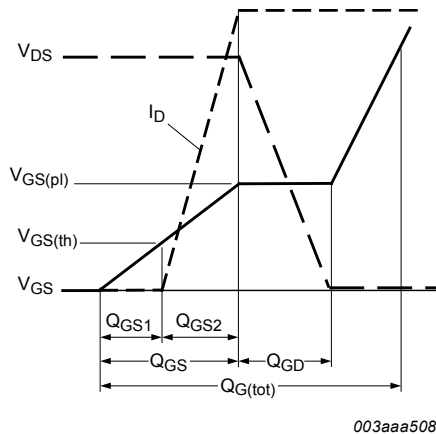


Fig. 13. Gate charge waveform definitions

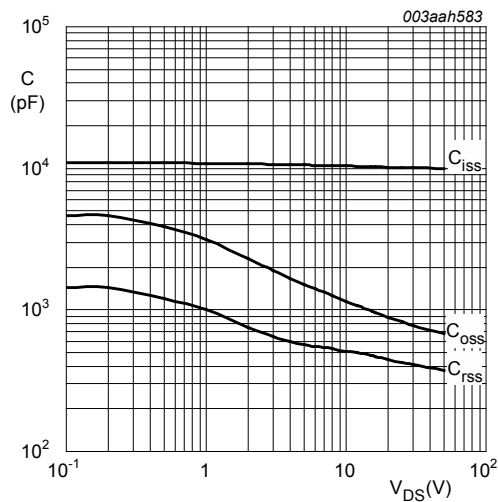


Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

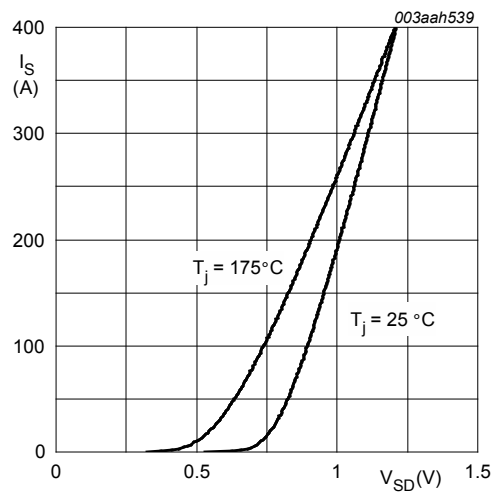


Fig. 16. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

$V_{GS} = 0V$

11. Package outline

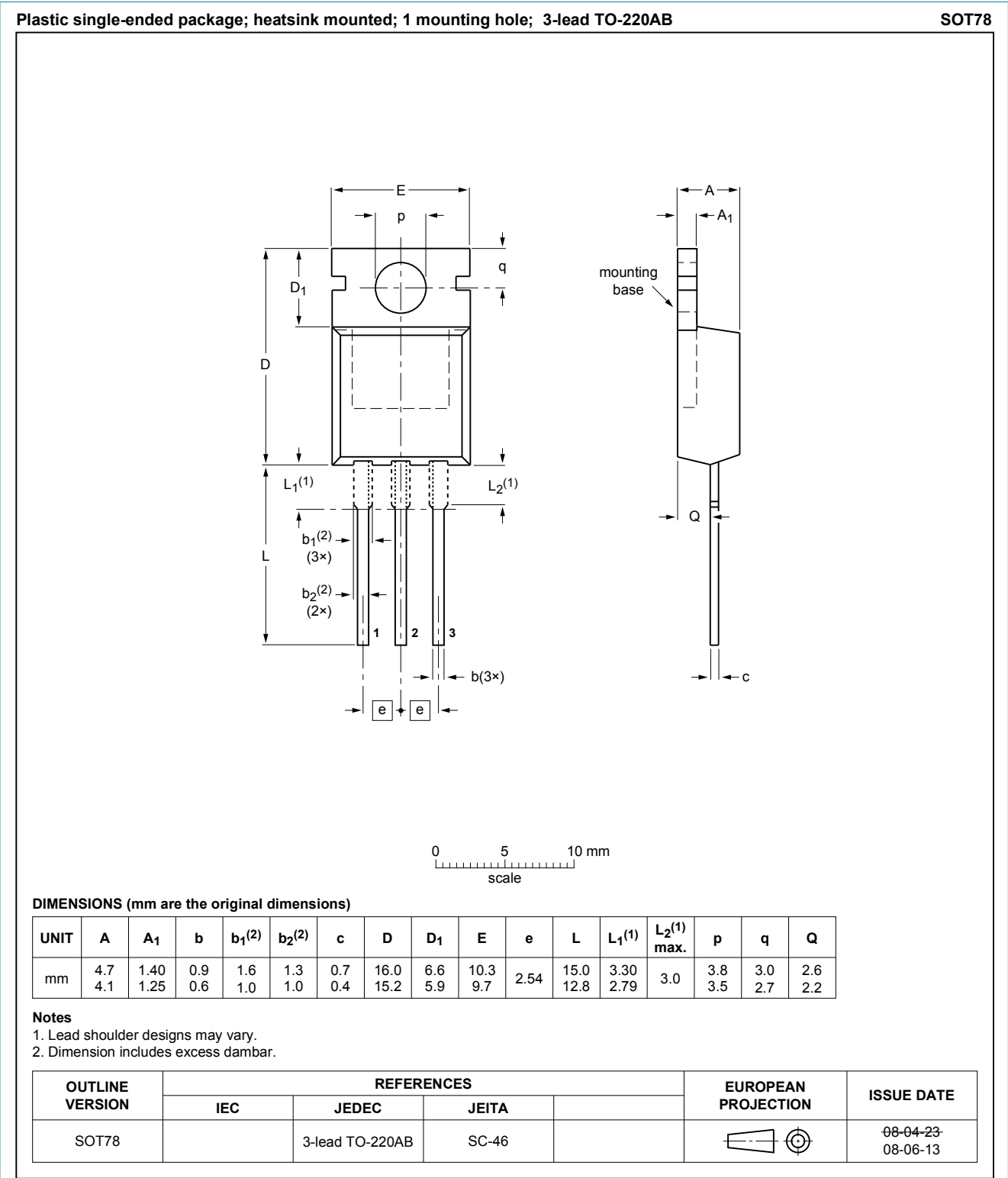


Fig. 17. Package outline TO-220AB (SOT78)

12. Legal information

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Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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Date of release: 7 February 2013