



PSMN7R8-120PS

N-channel 120V 7.9mΩ standard level MOSFET in TO220

25 January 2013

Product data sheet

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 power supply equipment.

2. Features and benefits

- High efficiency due to low switching and conduction losses
- TO220 package
- Suitable for standard level gate drive

3. Applications

- AC-to-DC power supply
- Synchronous rectification
- Motor control

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		-	-	120	V
I _D	drain current	T _{mb} = 25 °C; V _{GS} = 10 V; Fig. 1		-	-	70	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 2		-	-	349	W
Static characteristics							
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 25 A; T _j = 25 °C; Fig. 12		4.7	6.72	7.9	mΩ
Dynamic characteristics							
Q _{GD}	gate-drain charge	V _{GS} = 10 V; I _D = 25 A; V _{DS} = 60 V; Fig. 14 ; Fig. 15		-	50.5	-	nC
Q _{G(tot)}	total gate charge			-	167	-	nC
Avalanche ruggedness							
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	V _{GS} = 10 V; T _{j(init)} = 25 °C; I _D = 70 A; V _{sup} ≤ 120 V; unclamped; R _{GS} = 50 Ω; Fig. 3		-	-	386	mJ

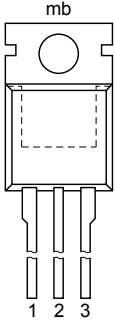
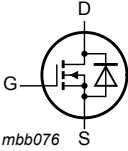


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5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 TO-220AB (SOT78)	 mbb076
2	D	drain		
3	S	source		
mb	D	drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN7R8-120PS	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
PSMN7R8-120PS	PSMN7R8-120PS

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	$T_j \geq 25\text{ }^{\circ}\text{C}$; $T_j \leq 175\text{ }^{\circ}\text{C}$	-	120	V
V_{DGR}	drain-gate voltage	$T_j \geq 25\text{ }^{\circ}\text{C}$; $T_j \leq 175\text{ }^{\circ}\text{C}$; $R_{GS} = 20\text{ k}\Omega$	-	120	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ }^{\circ}\text{C}$; Fig. 1	-	70	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ }^{\circ}\text{C}$; Fig. 1	-	70	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ }^{\circ}\text{C}$; Fig. 4	-	280	A

Symbol	Parameter	Conditions		Min	Max	Unit
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Fig. 2		-	349	W
T_{stg}	storage temperature			-55	175	°C
T_j	junction temperature			-55	175	°C
$T_{sld(M)}$	peak soldering temperature			-	260	°C
Source-drain diode						
I_S	source current	$T_{mb} = 25\text{ °C}$		-	70	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$		-	280	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 70\text{ A}$; $V_{sup} \leq 120\text{ V}$; unclamped; $R_{GS} = 50\text{ }\Omega$; Fig. 3		-	386	mJ

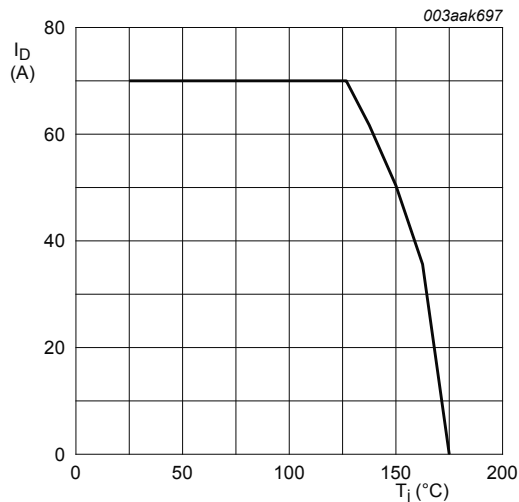


Fig. 1. Continuous drain current as a function of mounting base temperature

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

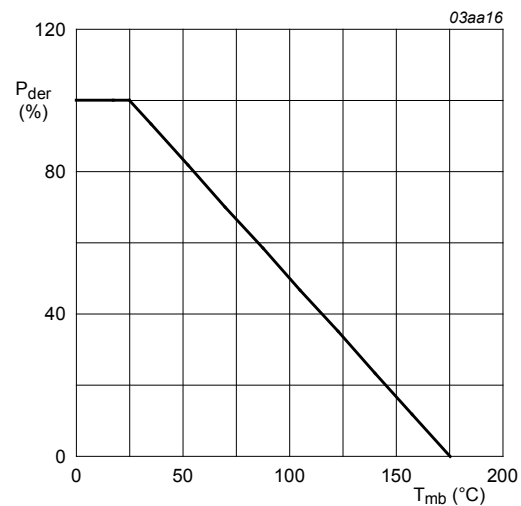


Fig. 2. Normalized total power dissipation as a function of mounting base temperature

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

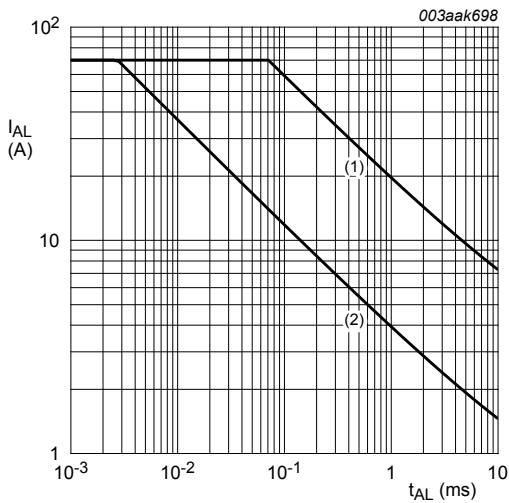


Fig. 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time

- (1) Single-pulse; $T_j = 25\text{ }^{\circ}\text{C}$.
(2) Single-pulse; $T_j = 125\text{ }^{\circ}\text{C}$.

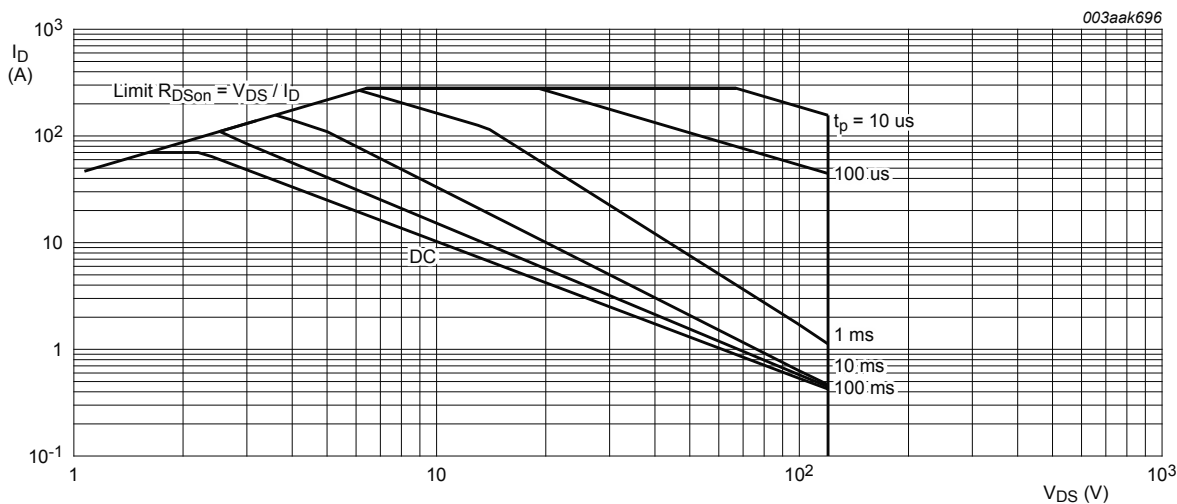


Fig. 4. Safe operating area; continuous and peak drain current as a function of drain-source voltage

$T_{mb} = 25\text{ }^{\circ}\text{C}$; I_{DM} is 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	-	0.35	0.43	K/W

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in free air	-	60	-	K/W

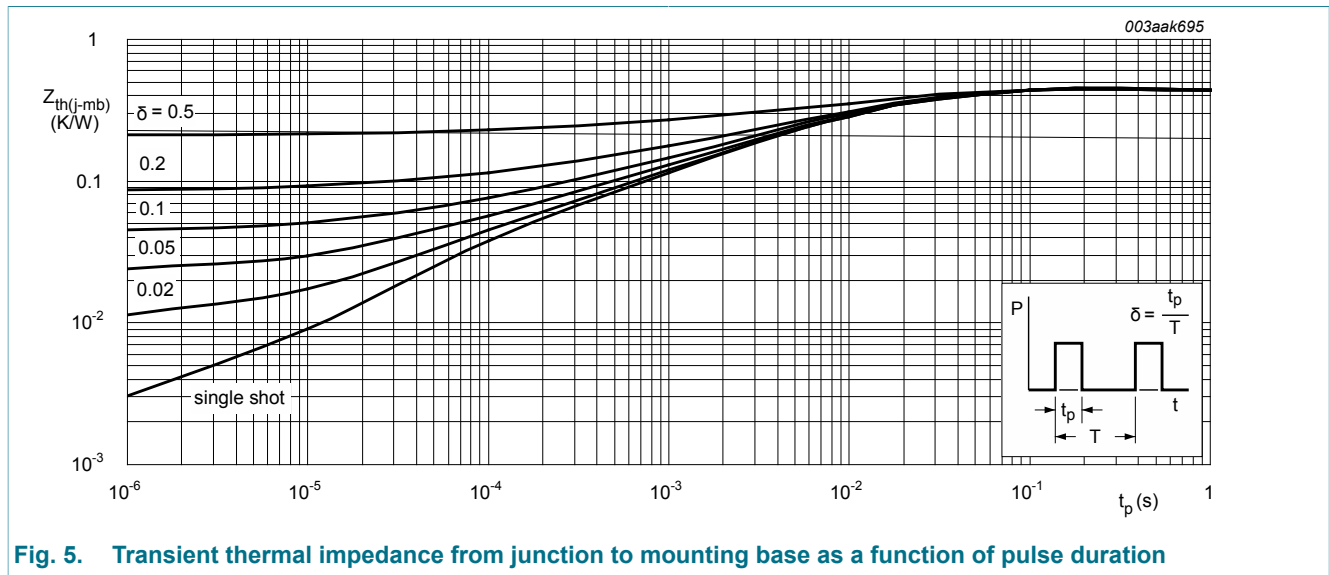


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A$; $V_{GS} = 0 V$; $T_J = 25 ^\circ C$	120	-	-	V
		$I_D = 250 \mu A$; $V_{GS} = 0 V$; $T_J = -55 ^\circ C$	108	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 mA$; $V_{DS} = V_{GS}$; $T_J = 25 ^\circ C$; Fig. 10 ; Fig. 11	2	3	4	V
		$I_D = 1 mA$; $V_{DS} = V_{GS}$; $T_J = 175 ^\circ C$; Fig. 10	1	-	-	V
		$I_D = 1 mA$; $V_{DS} = V_{GS}$; $T_J = -55 ^\circ C$; Fig. 10	-	-	4.6	V
I_{DSS}	drain leakage current	$V_{DS} = 120 V$; $V_{GS} = 0 V$; $T_J = 25 ^\circ C$	-	0.1	1	μA
		$V_{DS} = 120 V$; $V_{GS} = 0 V$; $T_J = 175 ^\circ C$	-	-	500	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 V$; $V_{DS} = 0 V$; $T_J = 25 ^\circ C$	-	10	100	nA
		$V_{GS} = -20 V$; $V_{DS} = 0 V$; $T_J = 25 ^\circ C$	-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 V$; $I_D = 25 A$; $T_J = 25 ^\circ C$; Fig. 12	4.7	6.72	7.9	mΩ
		$V_{GS} = 10 V$; $I_D = 25 A$; $T_J = 175 ^\circ C$; Fig. 12 ; Fig. 13	-	19.3	22.9	mΩ

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R _G	internal gate resistance (AC)	f = 1 MHz		0.39	0.78	1.56	Ω
Dynamic characteristics							
Q _{G(tot)}	total gate charge	I _D = 25 A; V _{DS} = 60 V; V _{GS} = 10 V; Fig. 14 ; Fig. 15		-	167	-	nC
Q _{GS}	gate-source charge			-	36.9	-	nC
Q _{GS(th)}	pre-threshold gate-source charge			-	24.2	-	nC
Q _{GS(th-pl)}	post-threshold gate-source charge			-	12.7	-	nC
Q _{GD}	gate-drain charge			-	50.5	-	nC
V _{GS(pl)}	gate-source plateau voltage	I _D = 25 A; V _{DS} = 60 V; Fig. 14 ; Fig. 15		-	4.5	-	V
C _{iss}	input capacitance	V _{DS} = 60 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C; Fig. 16		-	9473	-	pF
C _{oss}	output capacitance			-	441	-	pF
C _{rss}	reverse transfer capacitance			-	298	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = 60 V; R _L = 2.4 Ω; V _{GS} = 10 V; R _{G(ext)} = 5 Ω; T _j = 25 °C		-	45.5	-	ns
t _r	rise time			-	55.3	-	ns
t _{d(off)}	turn-off delay time			-	151.8	-	ns
t _f	fall time			-	60.8	-	ns
Source-drain diode							
V _{SD}	source-drain voltage	I _S = 25 A; V _{GS} = 0 V; T _j = 25 °C; Fig. 17		-	0.81	1.2	V
t _{rr}	reverse recovery time	I _S = 25 A; di _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 60 V		-	75.7	-	ns
Q _r	recovered charge			-	264	-	nC

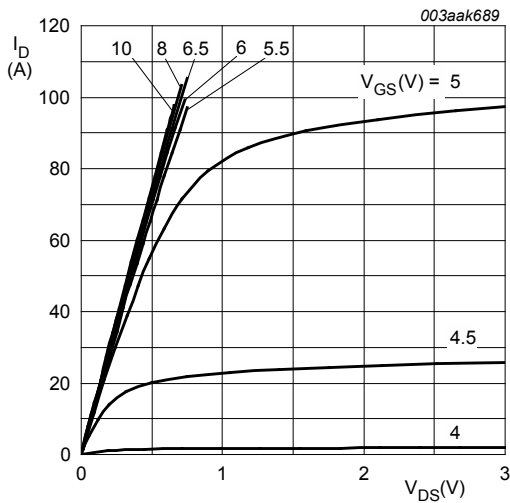


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

$T_j = 25\text{ }^{\circ}\text{C}$

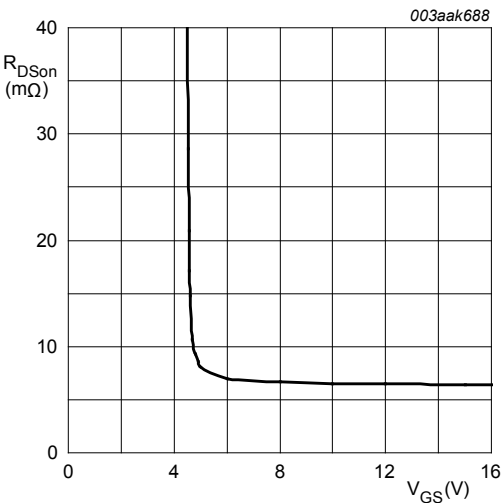


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25\text{ }^{\circ}\text{C}$

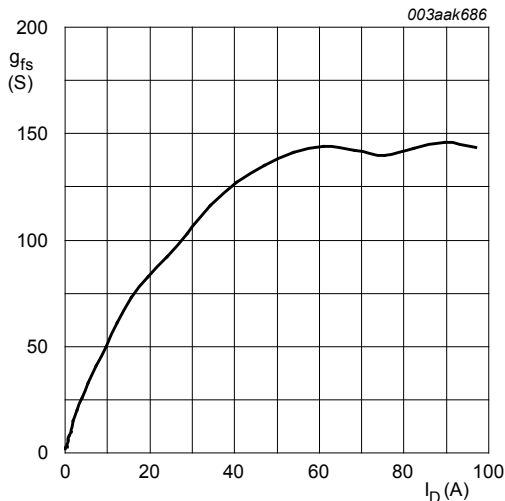


Fig. 8. Forward transconductance as a function of drain current; typical values

$T_j = 25\text{ }^{\circ}\text{C}; V_{DS} = 10\text{ V}$

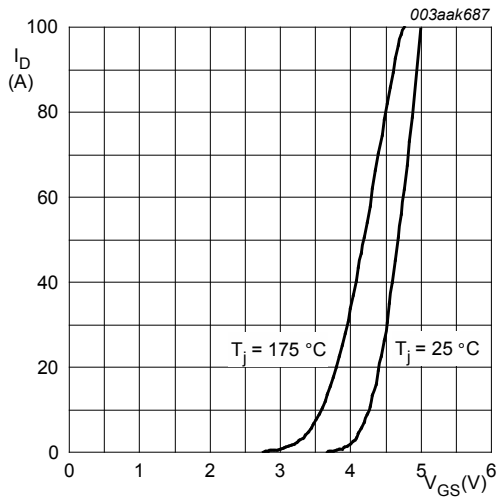


Fig. 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values

$V_{DS} > I_D \times R_{DSon}$

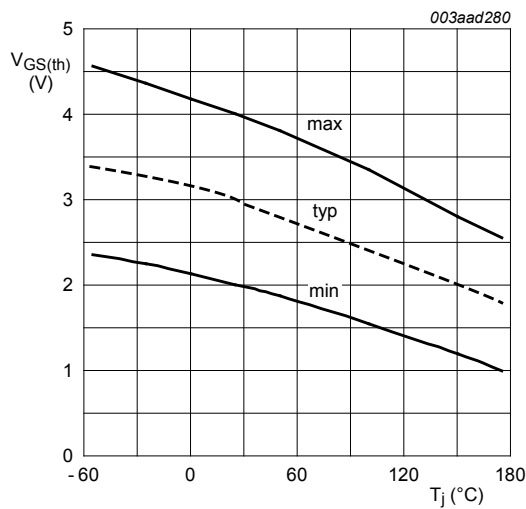


Fig. 10. Gate-source threshold voltage as a function of junction temperature

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

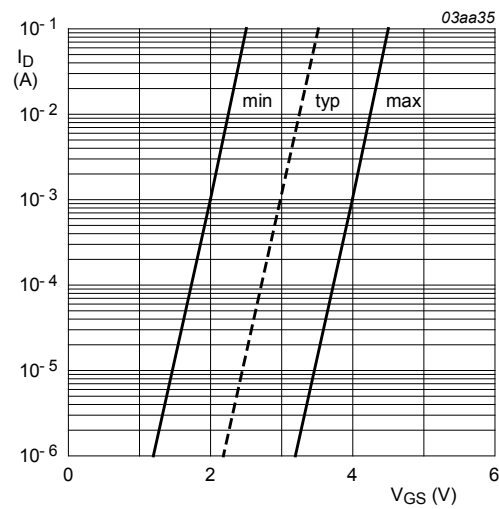


Fig. 11. Sub-threshold drain current as a function of gate-source voltage

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

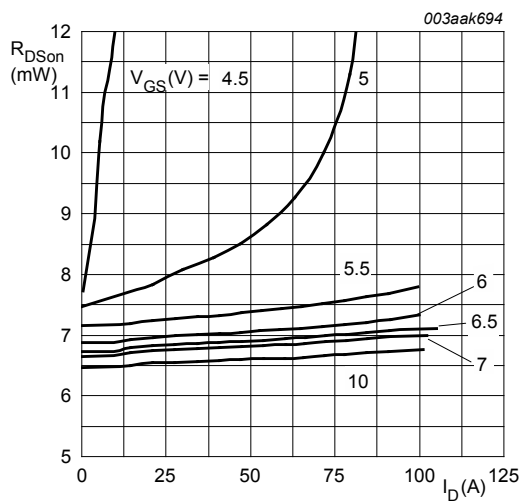


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

$T_j = 25\text{ }^{\circ}\text{C}$

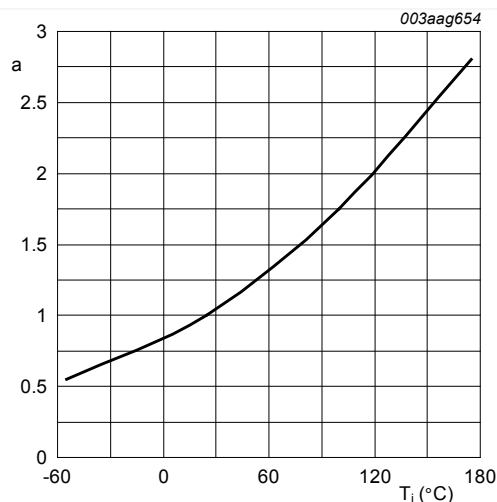


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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

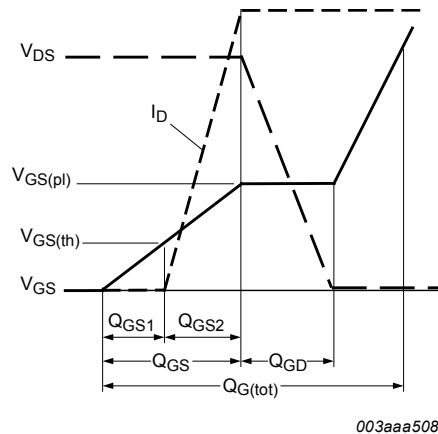


Fig. 14. Gate charge waveform definitions

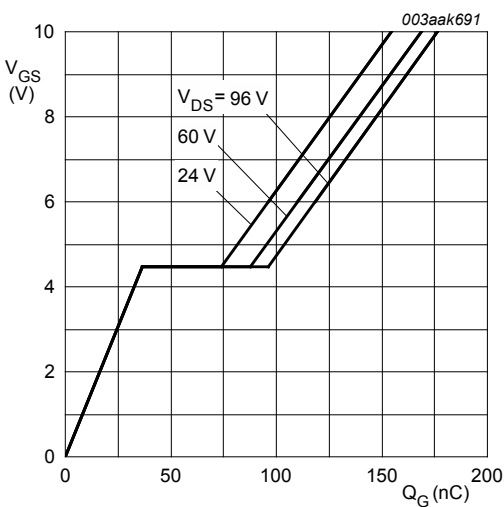


Fig. 15. Gate-source voltage as a function of gate charge; typical values

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

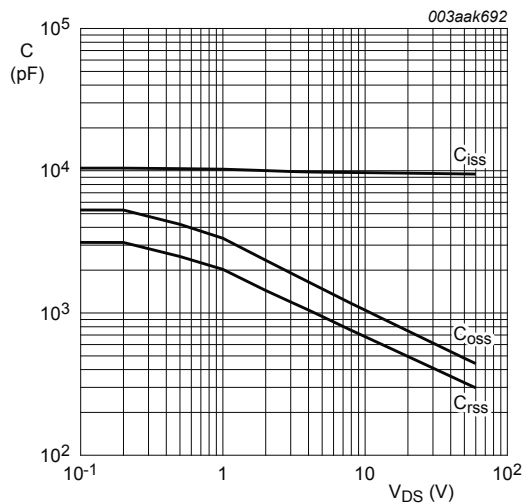


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

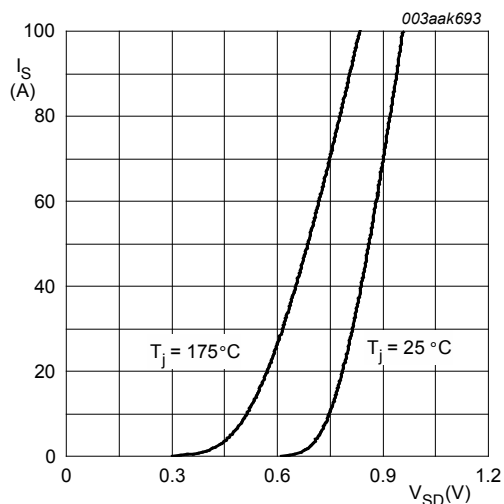


Fig. 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

$V_{GS} = 0 V$

11. Package outline

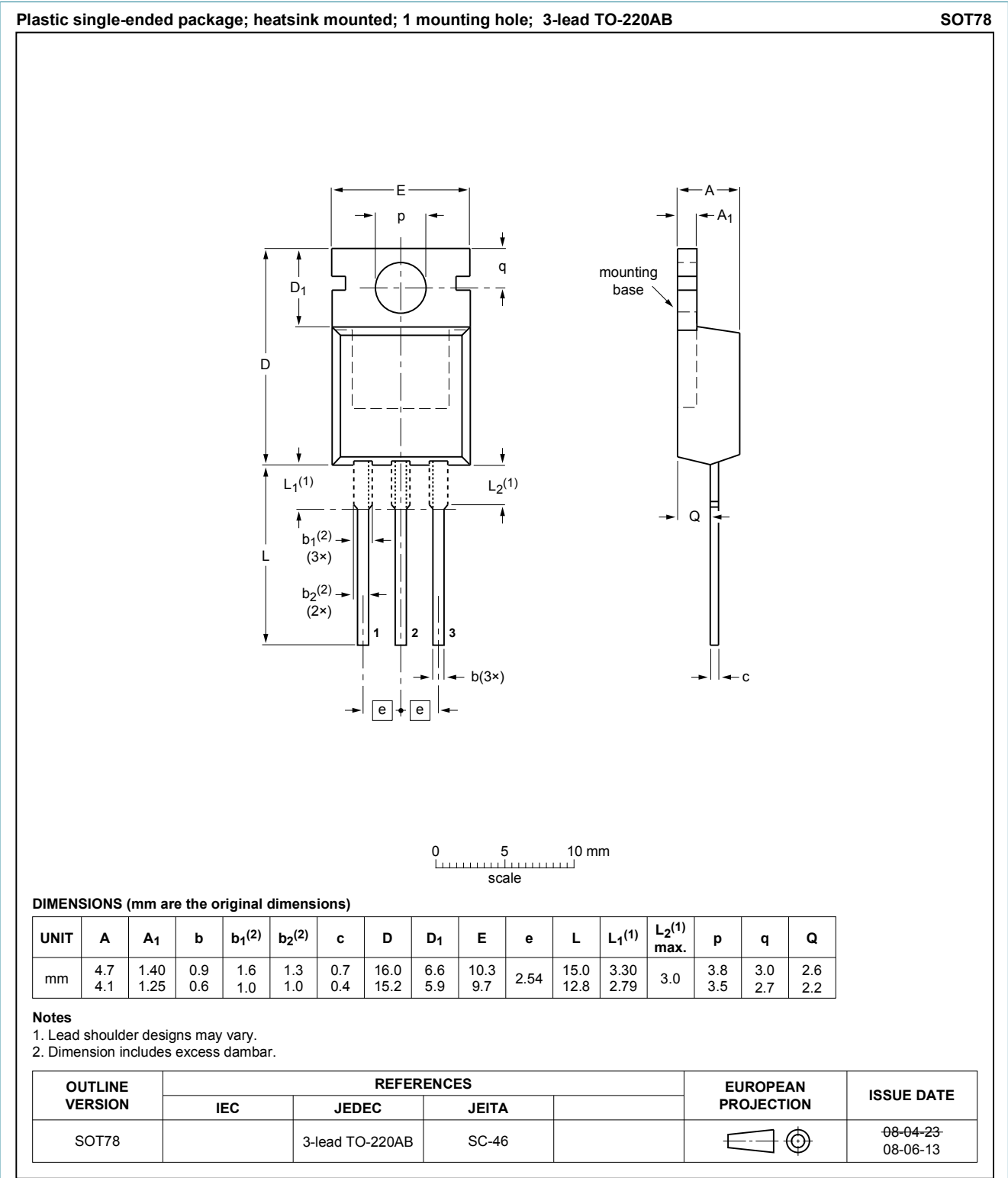


Fig. 18. Package outline TO-220AB (SOT78)

12. Legal information

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Document status [1][2]	Product status [3]	Definition
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