



PSMN1R1-30PL

N-channel 30 V 1.3 mΩ logic level MOSFET in TO-220

2 April 2014

Product data sheet

1. General description

Logic level N-channel MOSFET in TO-220 package qualified to 175 °C. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

2. Features and benefits

- High efficiency due to low switching and conduction losses
- Suitable for logic level gate drive sources

3. Applications

- DC-to-DC converters
- Load switching
- Motor control
- Server 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		-	-	30	V
I _D	drain current	T _{mb} = 25 °C; V _{GS} = 10 V; Fig. 2	[1]	-	-	120	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 1		-	-	338	W
T _j	junction temperature			-55	-	175	°C
Static characteristics							
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 25 A; T _j = 25 °C; Fig. 12	[2]	-	1.1	1.3	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 100 °C; Fig. 13		-	1.5	1.8	mΩ
Dynamic characteristics							
Q _{GD}	gate-drain charge	V _{GS} = 4.5 V; I _D = 75 A; V _{DS} = 15 V; Fig. 14 ; Fig. 15		-	37	-	nC
Q _{G(tot)}	total gate charge			-	118	-	nC



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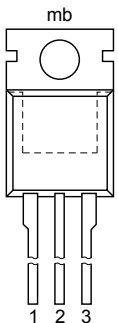
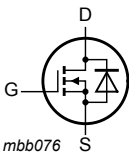
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 120\text{ A}$; $V_{sup} \leq 30\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped	-	-	1.9	J

[1] Continuous current is limited by package.

[2] Measured 3 mm from package.

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p>TO-220AB (SOT78)</p>	
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN1R1-30PL	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
PSMN1R1-30PL	PSMN1R1-30PL

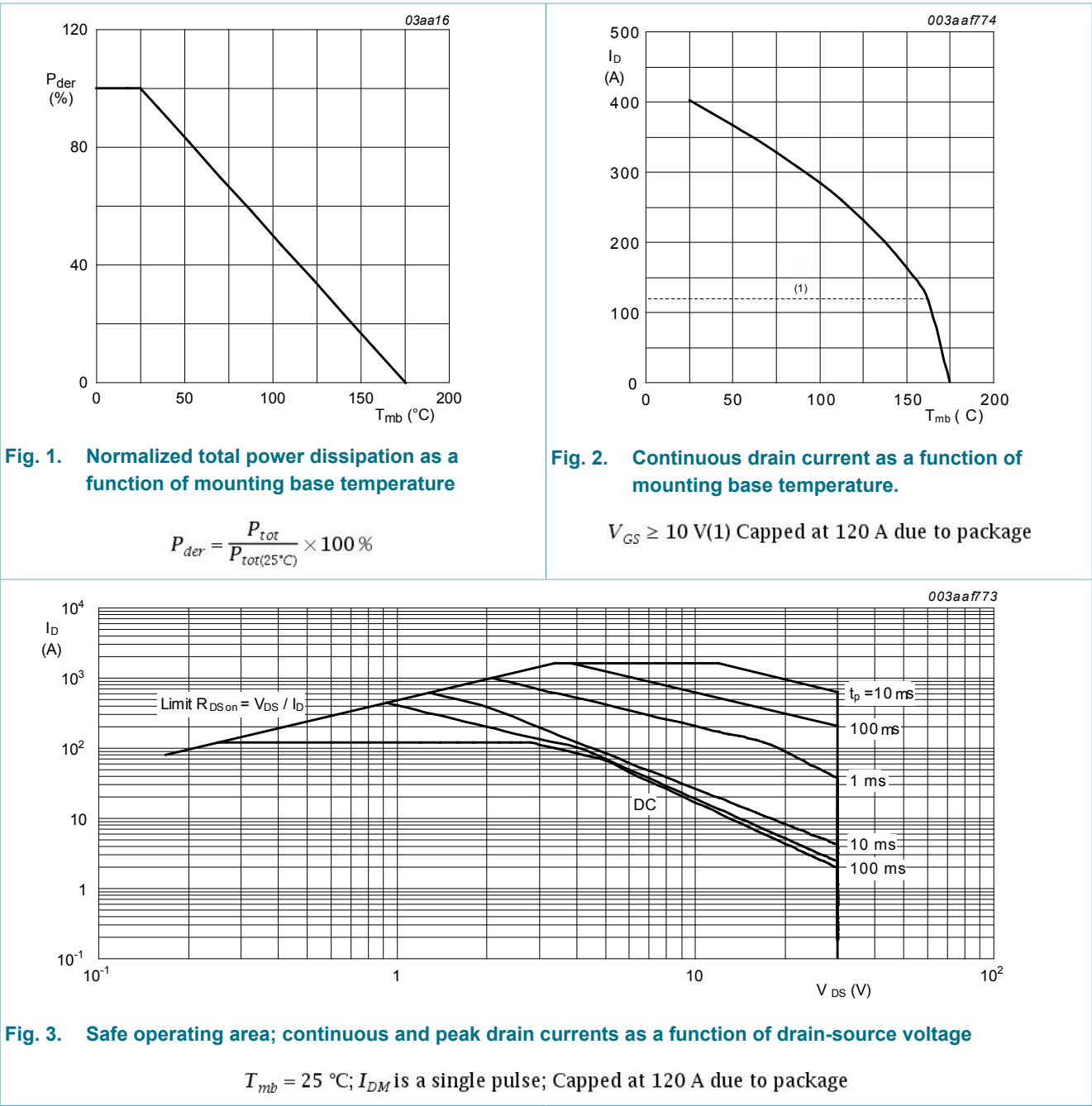
8. Limiting values

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	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$		-	30	V
V_{DGR}	drain-gate voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}; R_{GS} = 20\text{ k}\Omega$		-	30	V
V_{GS}	gate-source voltage			-20	20	V
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Fig. 1		-	338	W
I_D	drain current	$V_{GS} = 10\text{ V}; T_{mb} = 100\text{ °C}$; Fig. 2	[1]	-	120	A
		$V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C}$; Fig. 2	[1]	-	120	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$; Fig. 3		-	1609	A
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	$T_{mb} = 25\text{ °C}$	[1]	-	120	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$		-	1609	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ °C}; I_D = 120\text{ A}; V_{sup} \leq 30\text{ V}; R_{GS} = 50\text{ }\Omega$; unclamped		-	1.9	J

[1] Continuous current is limited by package.



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. 4	-	0.22	0.44	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

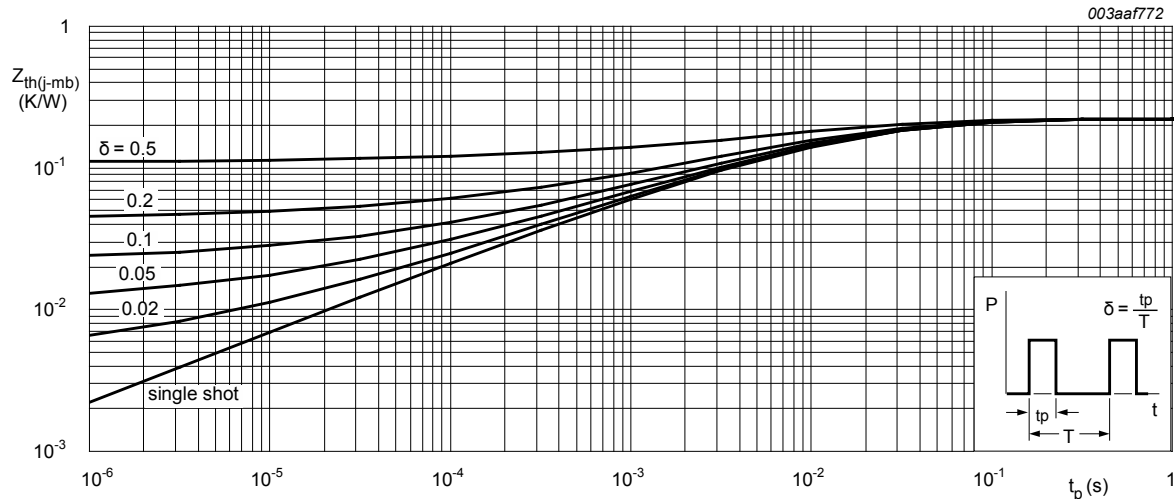


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_J = 25 ^\circ C$	30	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_J = -55 ^\circ C$	27	-	-	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	1.3	1.7	2.2	V
		$I_D = 2 mA; V_{DS} = V_{GS}; T_J = 175 ^\circ C$; Fig. 11	0.5	-	-	V
		$I_D = 1 mA; V_{DS} = V_{GS}; T_J = -55 ^\circ C$; Fig. 11	-	-	2.5	V
I_{DSS}	drain leakage current	$V_{DS} = 30 V; V_{GS} = 0 V; T_J = 25 ^\circ C$	-	0.02	10	μA
		$V_{DS} = 30 V; V_{GS} = 0 V; T_J = 175 ^\circ C$	-	250	500	μA
I_{GSS}	gate leakage current	$V_{GS} = 16 V; V_{DS} = 0 V; T_J = 25 ^\circ C$	-	10	100	nA
		$V_{GS} = -16 V; V_{DS} = 0 V; T_J = 25 ^\circ C$	-	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	[1]	1.1	1.3	mΩ

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
		V _{GS} = 4.5 V; I _D = 25 A; T _j = 25 °C; Fig. 12		-	1.2	1.4	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 175 °C; Fig. 13 ; Fig. 12		-	2.1	2.5	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 100 °C; Fig. 13		-	1.5	1.8	mΩ
R _G	gate resistance	f = 1 MHz		-	1.1	-	Ω
Dynamic characteristics							
Q _{G(tot)}	total gate charge	I _D = 75 A; V _{DS} = 15 V; V _{GS} = 10 V; Fig. 14 ; Fig. 15		-	243	-	nC
		I _D = 0 A; V _{DS} = 0 V; V _{GS} = 10 V; Fig. 14 ; Fig. 15		-	223	-	nC
		I _D = 75 A; V _{DS} = 15 V; V _{GS} = 4.5 V; Fig. 14 ; Fig. 15		-	118	-	nC
Q _{GS}	gate-source charge			-	39	-	nC
Q _{GS(th)}	pre-threshold gate-source charge			-	22	-	nC
Q _{GS(th-pl)}	post-threshold gate-source charge			-	17	-	nC
Q _{GD}	gate-drain charge			-	37	-	nC
V _{GS(pl)}	gate-source plateau voltage	V _{DS} = 15 V; Fig. 14 ; Fig. 15		-	2.8	-	V
C _{iss}	input capacitance	V _{DS} = 15 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C; Fig. 16		-	14850	-	pF
C _{oss}	output capacitance			-	2799	-	pF
C _{rss}	reverse transfer capacitance			-	1215	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = 15 V; R _L = 0.2 Ω; V _{GS} = 4.5 V; R _{G(ext)} = 5 Ω; I _D = 75 A; T _j = 25 °C		-	95	-	ns
t _r	rise time			-	213	-	ns
t _{d(off)}	turn-off delay time			-	199	-	ns
t _f	fall time			-	115	-	ns
Source-drain diode							
V _{SD}	source-drain voltage	I _S = 25 A; V _{GS} = 0 V; T _j = 25 °C; Fig. 17		-	0.8	1.2	V
t _{rr}	reverse recovery time	I _S = 25 A; dI _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 15 V		-	67	-	ns
Q _r	recovered charge			-	123	-	nC

[1] Measured 3 mm from package.

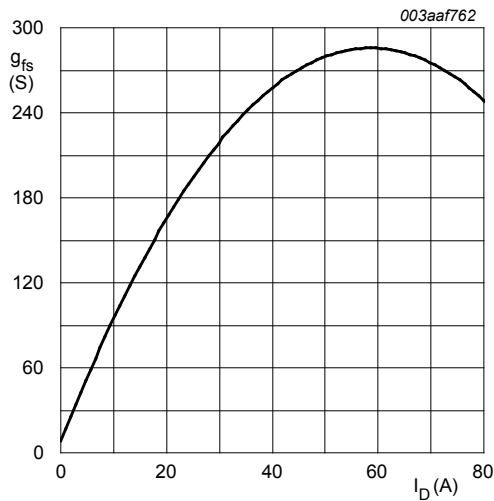


Fig. 5. Forward transconductance as a function of drain current; typical values

$T_j = 25\text{ }^{\circ}\text{C}; V_{DS} = 15\text{ V}$

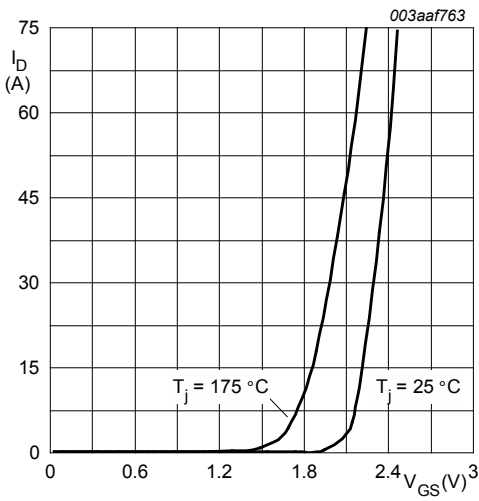


Fig. 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values

$V_{DS} = 15\text{ V}$

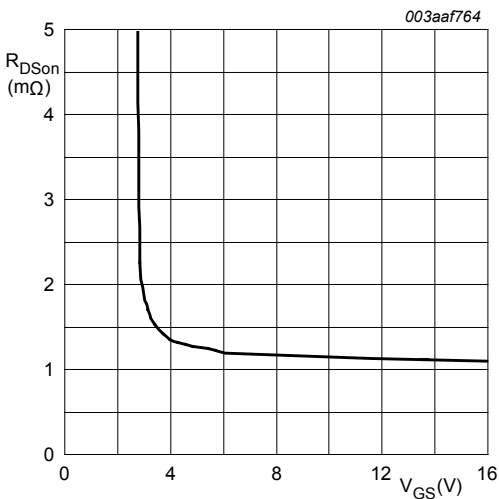


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

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

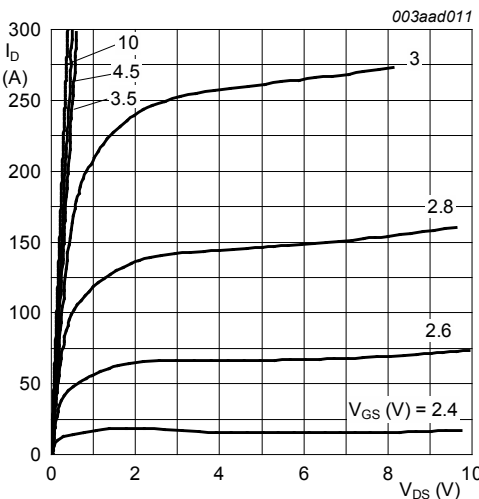


Fig. 8. Output characteristics: drain current as a function of drain-source voltage; typical values

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

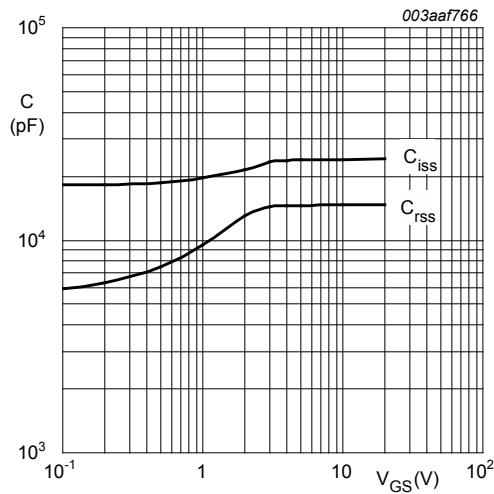


Fig. 9. Input and reverse transfer capacitances as a function of gate-source voltage; typical values

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

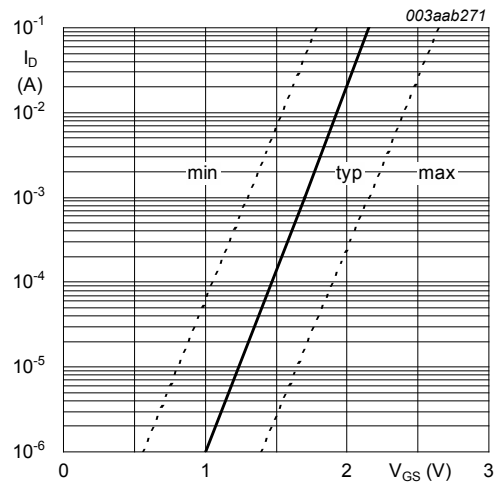


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

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

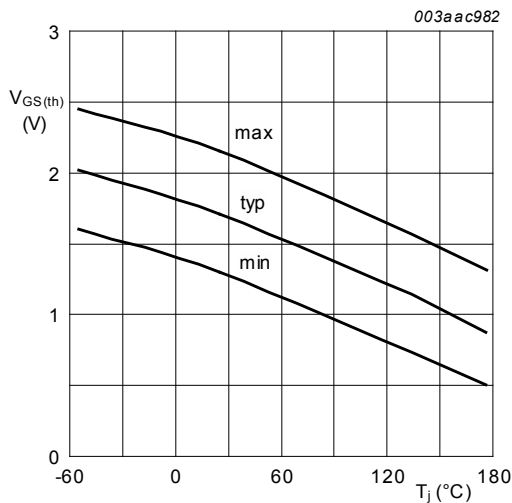


Fig. 11. Gate-source threshold voltage as a function of junction temperature

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

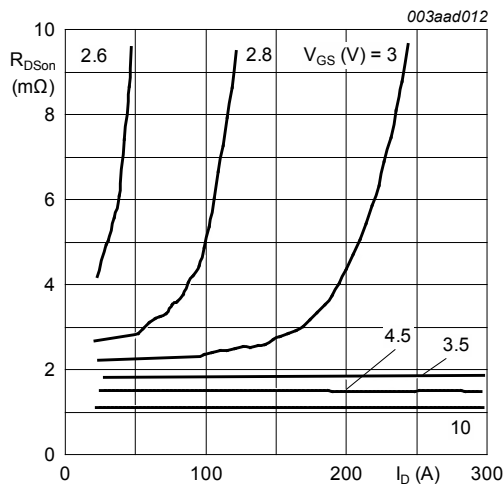


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

$T_j = 25^\circ C$

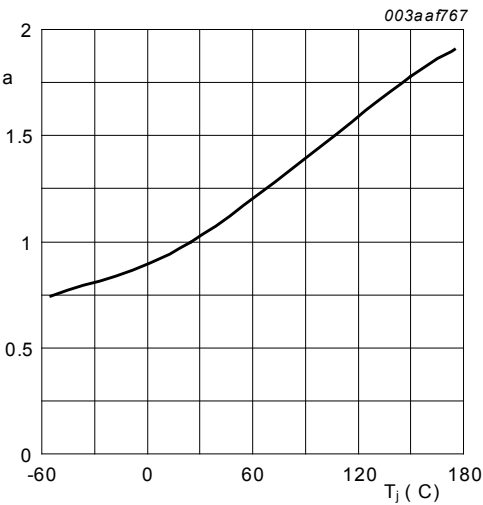


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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

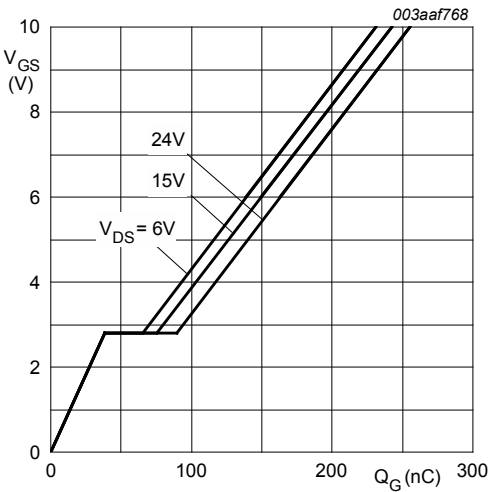


Fig. 15. Gate-source voltage as a function of gate charge; typical values

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

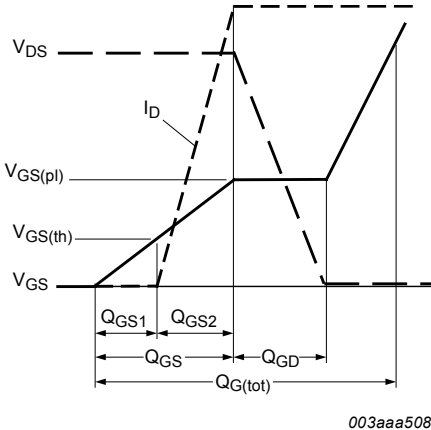


Fig. 14. Gate charge waveform definitions

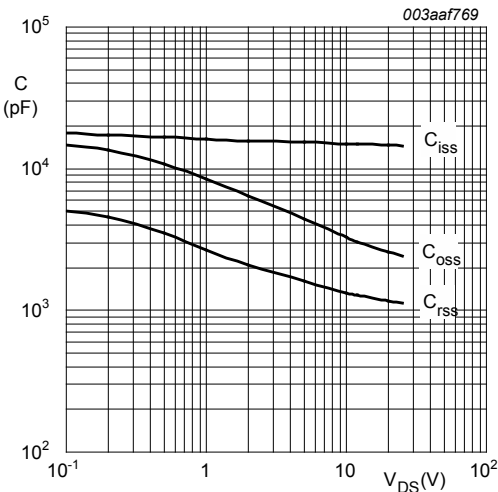


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

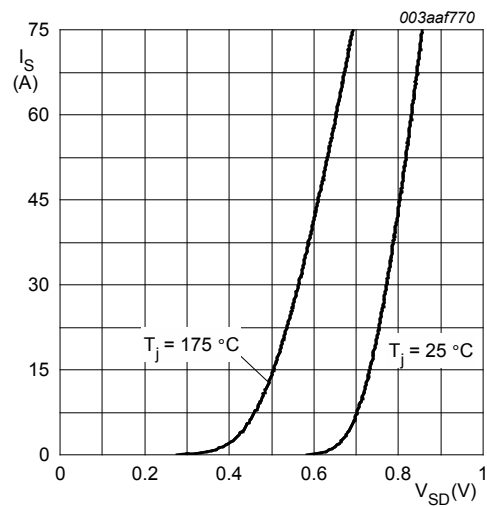


Fig. 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

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

11. Package outline

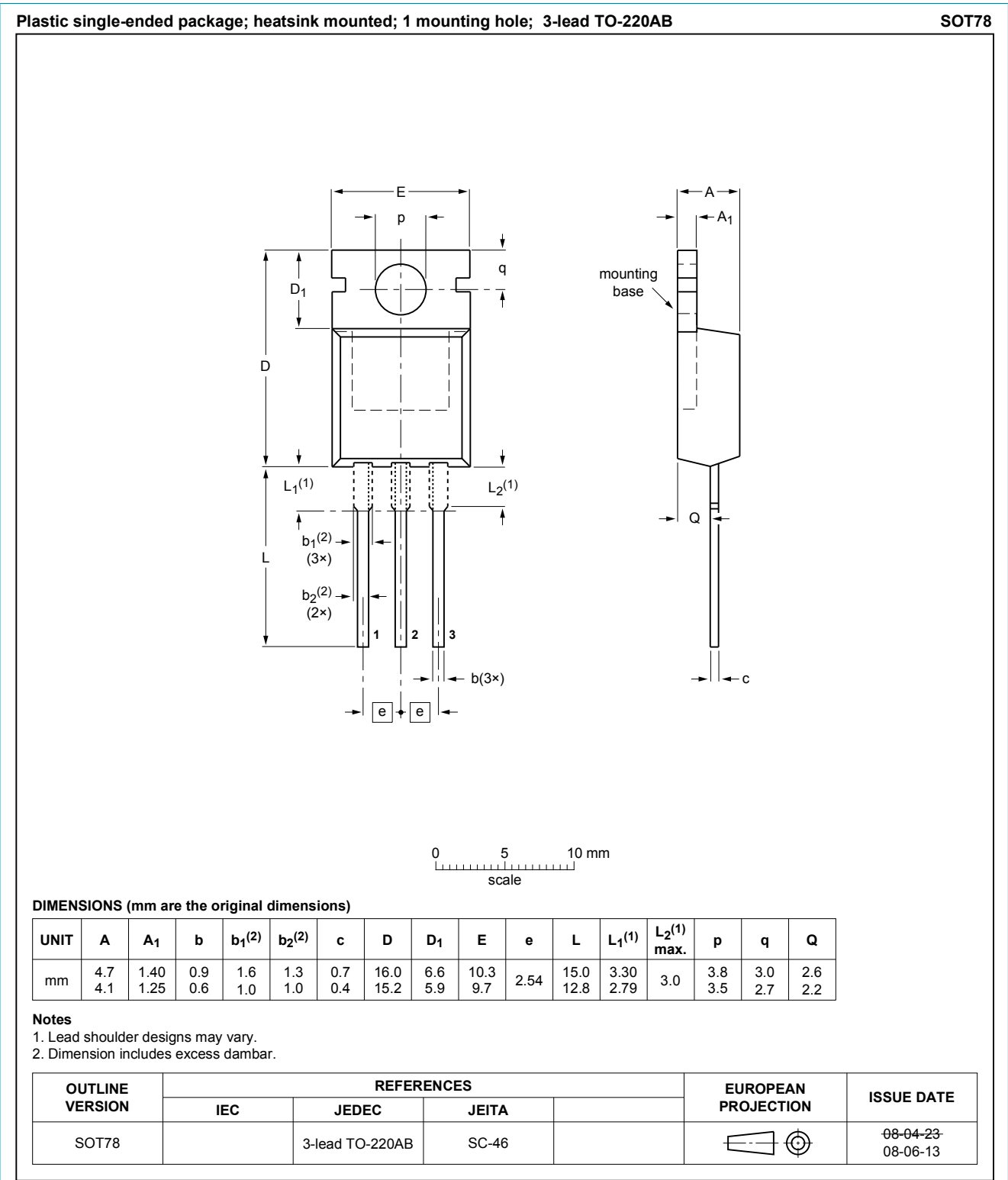


Fig. 18. Package outline TO-220AB (SOT78)

12. Legal information

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