



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 175C. 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	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	120	V
I_D	drain current	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V}; \text{Fig. 1}$	-	-	70	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}; \text{Fig. 2}$	-	-	349	W
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ °C}; \text{Fig. 12}$	4.7	6.72	7.9	mΩ
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; V_{DS} = 60\text{ V}; \text{Fig. 14}; \text{Fig. 15}$	-	50.5	-	nC
$Q_{G(tot)}$	total gate charge		-	167	-	nC
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(init)} = 25\text{ °C}; I_D = 70\text{ A}; V_{sup} \leq 120\text{ V}; \text{unclamped}; R_{GS} = 50\text{ } \Omega; \text{Fig. 3}$	-	-	386	mJ

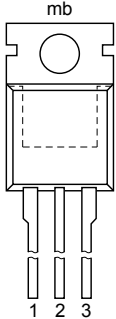
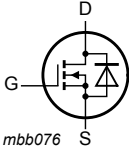


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5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p>TO-220AB (SOT78)</p>	 <p>mbb076</p>
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

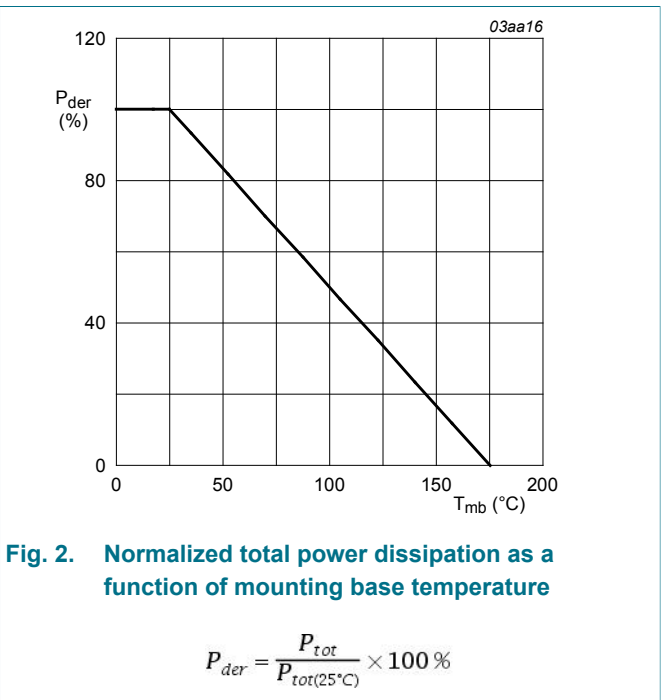
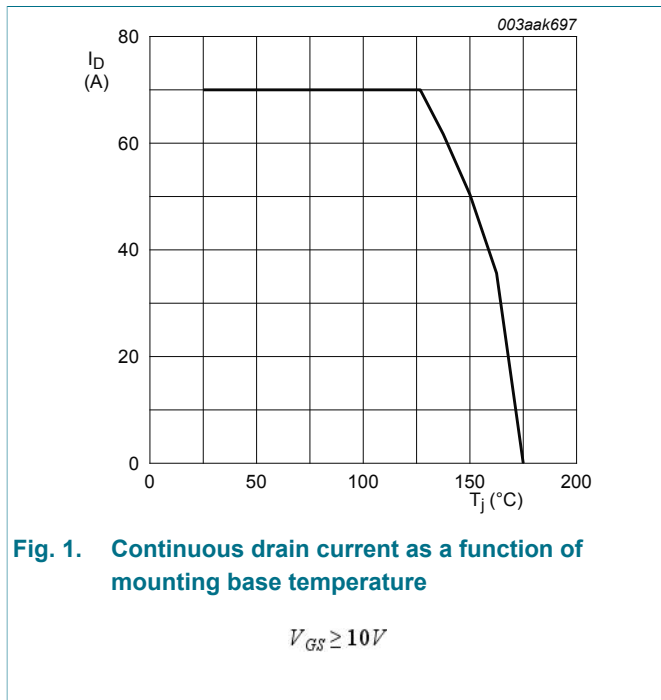
8. Limiting values

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



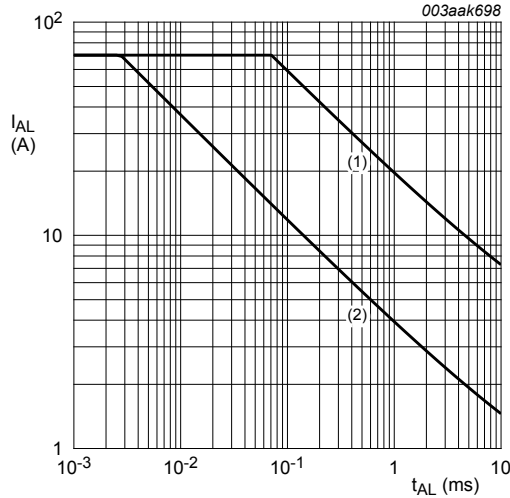


Fig. 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time

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

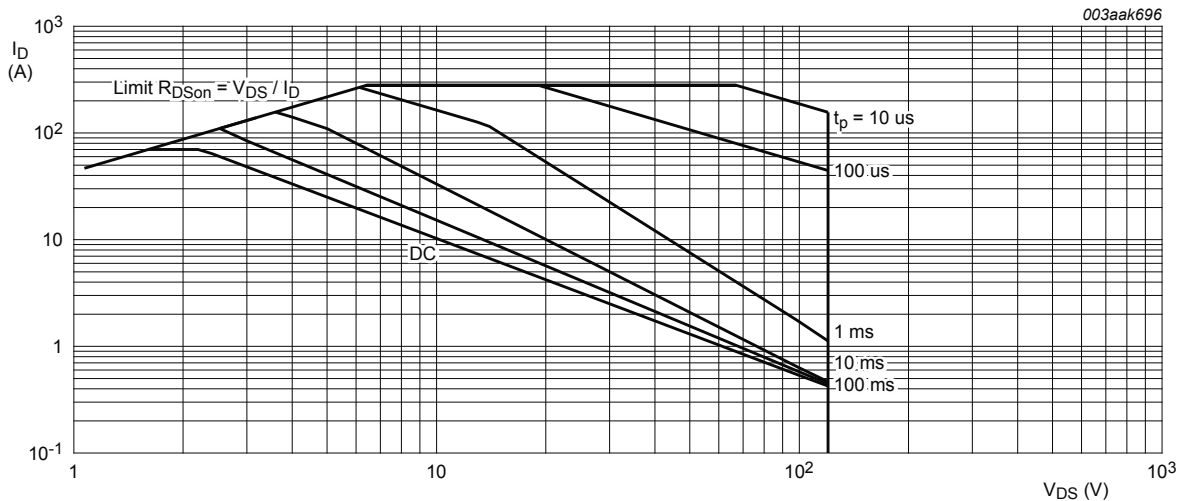


Fig. 4. Safe operating area; continuous and peak drain current as a function of drain-source voltage

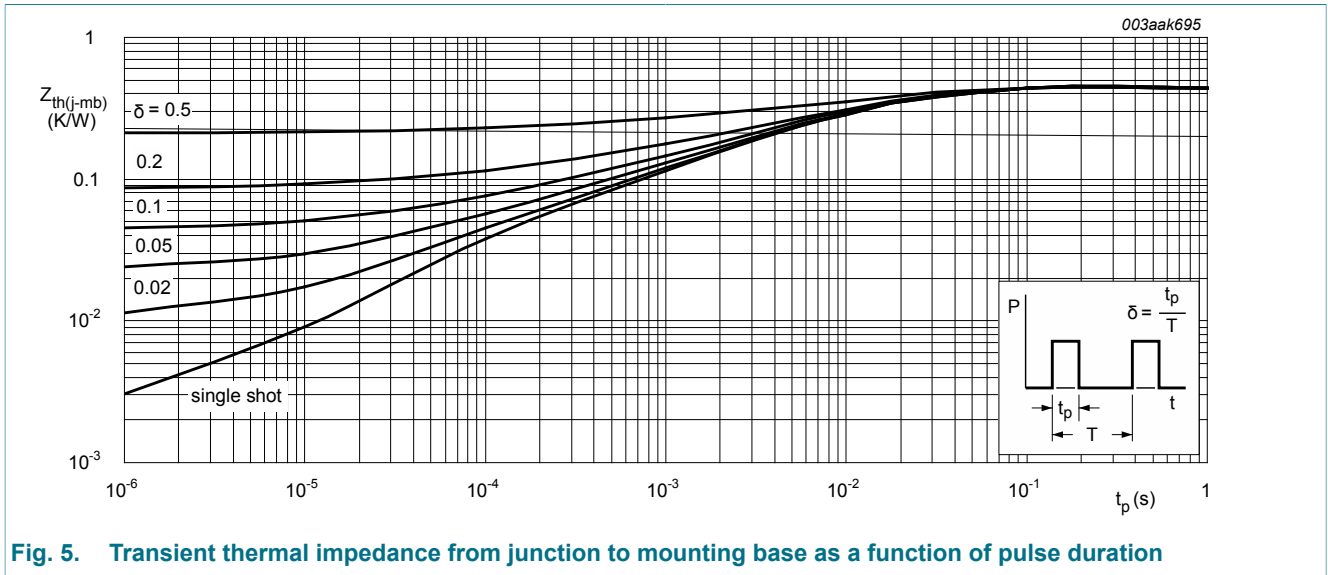
$T_{mb} = 25^\circ\text{C}$; I_{DM} is single pulse

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



10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	120	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	108	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C;$ Fig. 10; Fig. 11	2	3	4	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ C;$ Fig. 10	1	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C;$ Fig. 10	-	-	4.6	V
I_{DSS}	drain leakage current	$V_{DS} = 120 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	0.1	1	μA
		$V_{DS} = 120 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ C$	-	-	500	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	10	100	nA
		$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	10	100	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ C;$ Fig. 12	4.7	6.72	7.9	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ C;$ 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;	-	9473	-	pF
C _{oss}	output capacitance	T _j = 25 °C; Fig. 16	-	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;	-	45.5	-	ns
t _r	rise time	R _{G(ext)} = 5 Ω; T _j = 25 °C	-	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;	-	75.7	-	ns
Q _r	recovered charge	V _{DS} = 60 V	-	264	-	nC

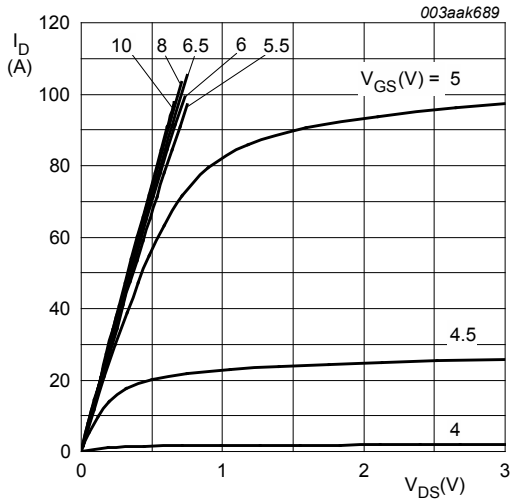


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

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

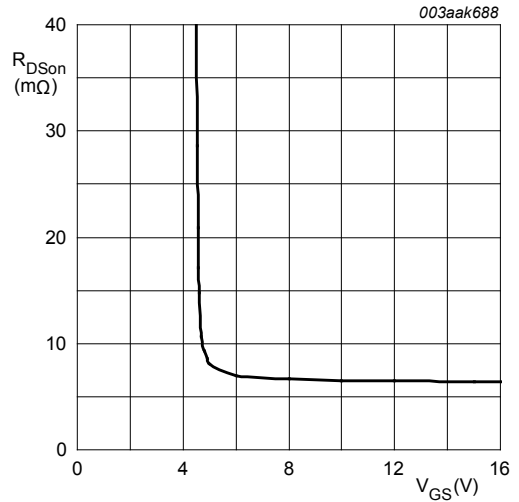


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

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

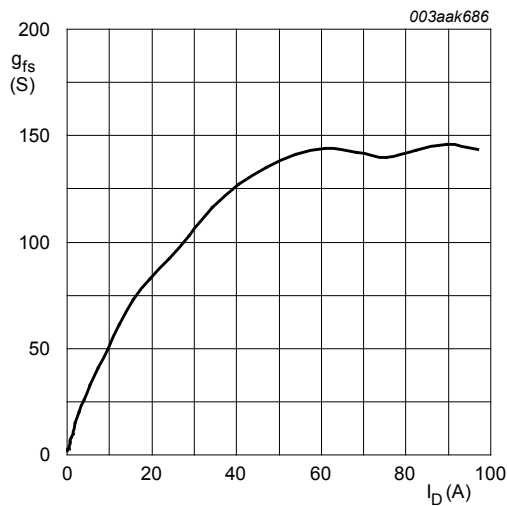


Fig. 8. Forward transconductance as a function of drain current; typical values

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

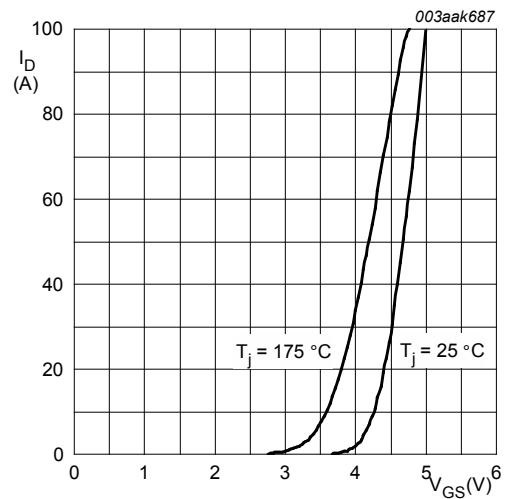


Fig. 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values

$V_{DS} > I_D \times R_{DS(on)}$

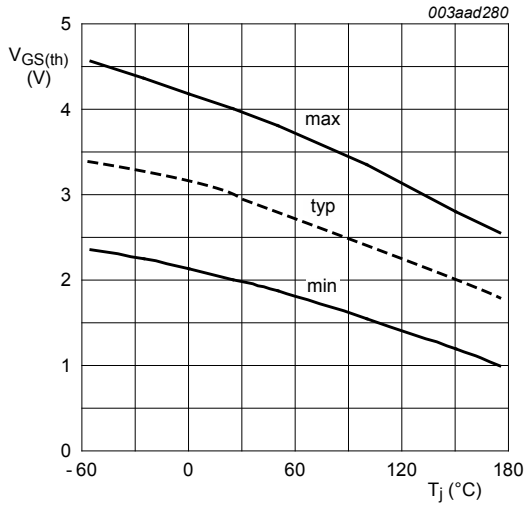


Fig. 10. Gate-source threshold voltage as a function of junction temperature

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

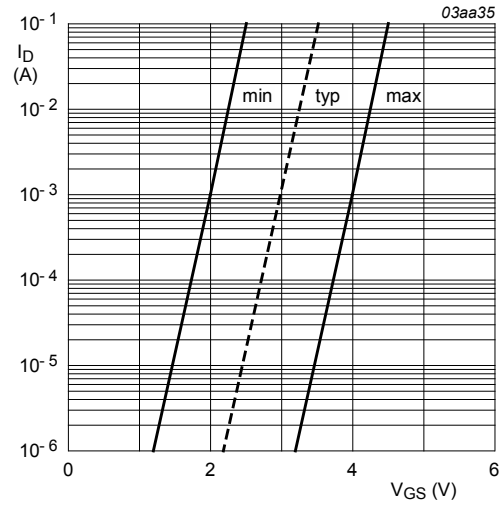


Fig. 11. Sub-threshold drain current as a function of gate-source voltage

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

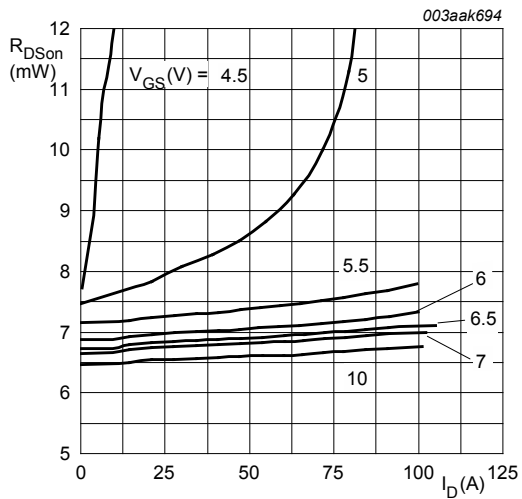


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

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

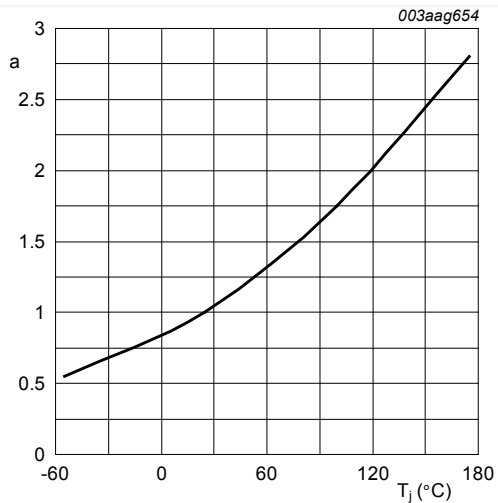


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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

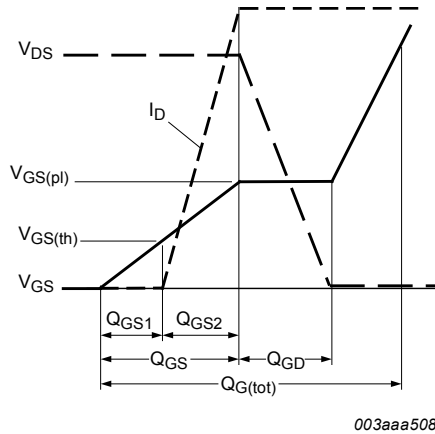


Fig. 14. Gate charge waveform definitions

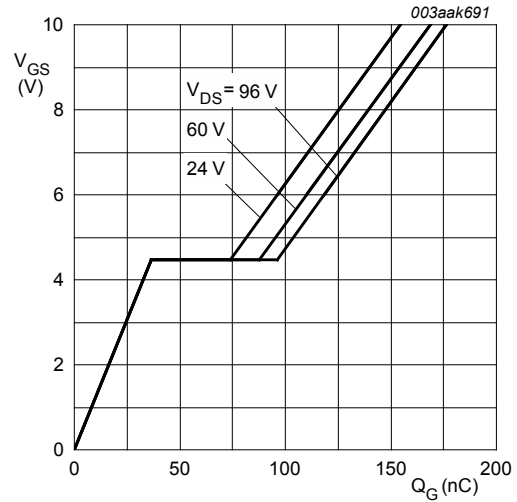


Fig. 15. Gate-source voltage as a function of gate charge; typical values

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

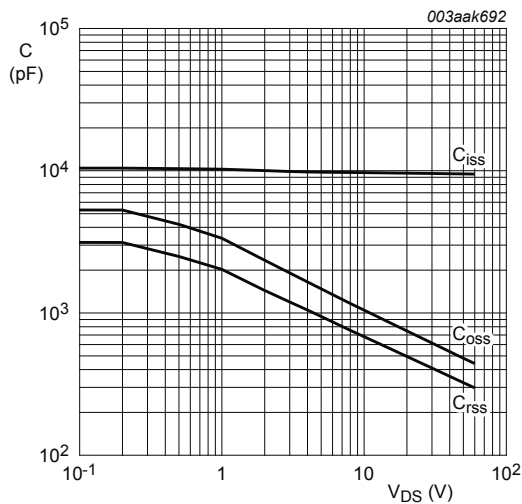


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

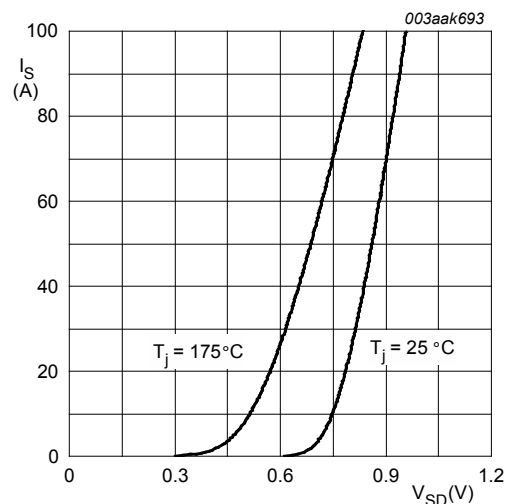


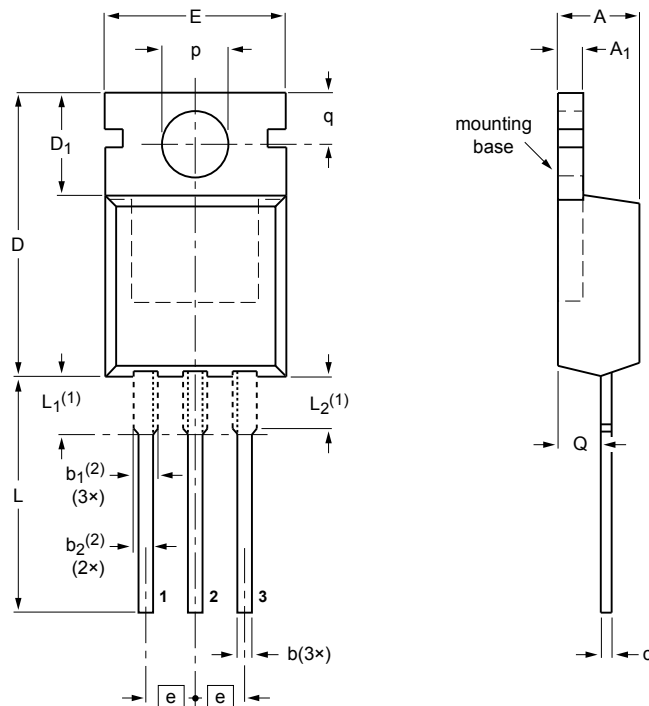
Fig. 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

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

11. Package outline

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

- Lead shoulder designs may vary.
- 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 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.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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