



PSMN1R9-80SSE

N-channel 80 V, 1.9 mOhm MOSFET with enhanced SOA in LPAK88

6 February 2023

Product data sheet

1. General description

N-channel enhancement mode MOSFET in a LPAK88 package qualified to 175 °C. Part of Nexperia's Application Specific MOSFETs (ASFETs) for Hotswap and Soft Start. The PSMN1R9-80SSE delivers very low $R_{DS(on)}$ and enhanced safe operating area performance in a high-reliability copper-clip LPAK88 package.

PSMN1R9-80SSE complements the latest "hot-swap" controllers – robust enough to withstand substantial inrush currents during turn-on, low $R_{DS(on)}$ to minimize I^2R losses and deliver optimum efficiency when turned fully ON.

2. Features and benefits

- Fully optimized Safe Operating Area (SOA) for superior linear mode operation
- Low $R_{DS(on)}$ for low I^2R conduction losses
- LPAK88 package for applications that demand the highest performance and reliability

3. Applications

- Hot swap
- Load switch
- Soft start
- E-fuse
- Telecommunication and computing systems based on a 48 V backplane/supply rail

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V _{DS}	drain-source voltage	25 °C ≤ T _j ≤ 175 °C		-	-	80	V
I _D	drain current	V _{GS} = 10 V; T _{mb} = 25 °C; Fig. 2		-	-	286	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 1		-	-	340	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		-	1.6	1.9	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 100 °C; Fig. 13		-	2.6	3	mΩ
Dynamic characteristics							
Q _{GD}	gate-drain charge	I _D = 25 A; V _{DS} = 40 V; V _{GS} = 10 V; T _j = 25 °C; Fig. 14 ; Fig. 15		7	23	53	nC
Q _{G(tot)}	total gate charge			77	155	232	nC

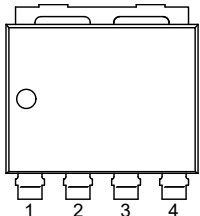
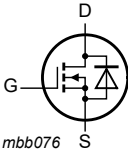
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Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 90\text{ A}$; $V_{sup} \leq 80\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$; unclamped; $t_p = 179\text{ }\mu\text{s}$; Fig. 4	[1]	-	-	840	mJ
Source-drain diode							
Q_r	recovered charge	$I_S = 25\text{ A}$; $di_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$; $V_{DS} = 40\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 18	[2]	-	60	-	nC

[1] Protected by 100% test
[2] includes capacitive recovery

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 LFPAK88 (SOT1235)	 mbb076
2	S	source		
3	S	source		
4	S	source		
mb	D	mounting base; connected to drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN1R9-80SSE	LFPAK88	plastic, single-ended surface-mounted package (LFPAK88); 4 leads; 2 mm pitch; 8 mm x 8 mm x 1.6 mm body	SOT1235

7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN1R9-80SSE	X1E9S80S

8. Limiting values

Table 5. Limiting values

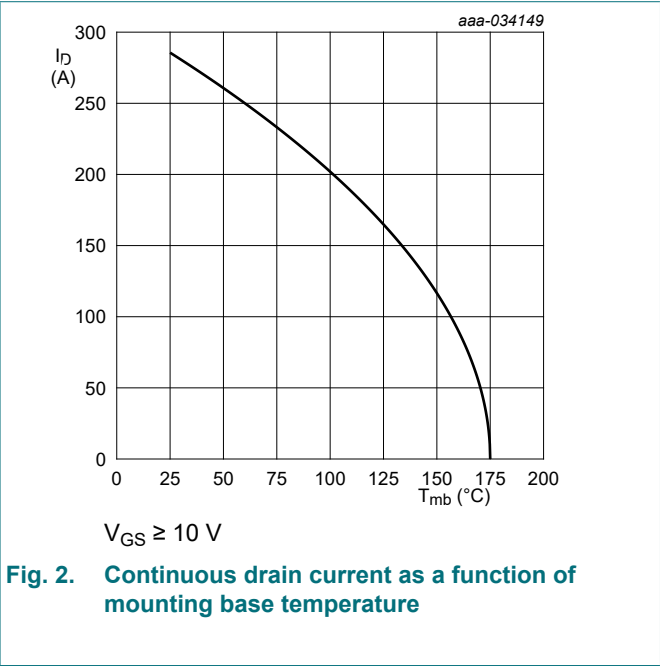
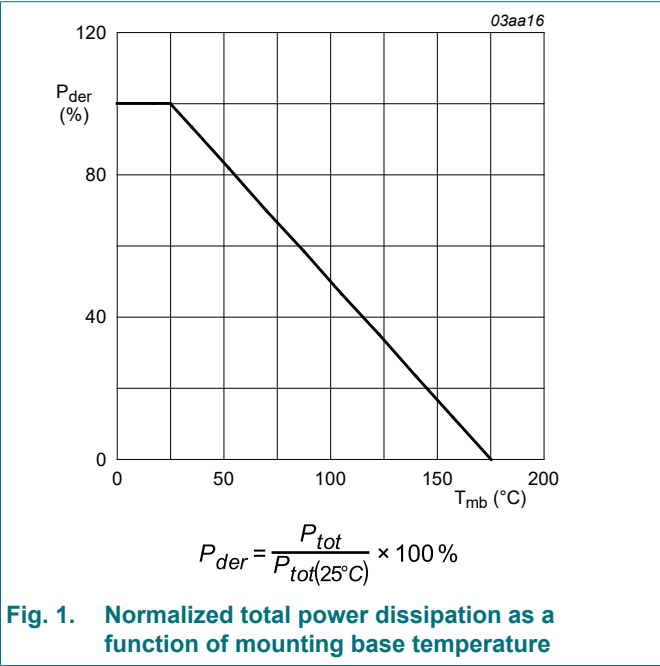
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	$25\text{ }^\circ\text{C} \leq T_j \leq 175\text{ }^\circ\text{C}$		-	80	V
V_{DGR}	drain-gate voltage	$25\text{ }^\circ\text{C} \leq T_j \leq 175\text{ }^\circ\text{C}$; $R_{GS} = 20\text{ k}\Omega$		-	80	V
V_{GS}	gate-source voltage			-20	20	V
P_{tot}	total power dissipation	$T_{mb} = 25\text{ }^\circ\text{C}$; Fig. 1		-	340	W

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Symbol	Parameter	Conditions		Min	Max	Unit
I _D	drain current	V _{GS} = 10 V; T _{mb} = 25 °C; Fig. 2		-	286	A
		V _{GS} = 10 V; T _{mb} = 100 °C; Fig. 2		-	202	A
I _{DM}	peak drain current	pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C; Fig. 3		-	1142	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 °C		-	286	A
I _{SM}	peak source current	pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C		-	1142	A
Avalanche ruggedness						
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	I _D = 90 A; V _{sup} ≤ 80 V; R _{GS} = 50 Ω; V _{GS} = 10 V; T _{j(init)} = 25 °C; unclamped; t _p = 179 μs; Fig. 4	[1]	-	840	mJ
I _{AS}	non-repetitive avalanche current	V _{sup} = 80 V; V _{GS} = 10 V; T _{j(init)} = 25 °C; R _{GS} = 50 Ω; Fig. 4	[1]	-	90	A

[1] Protected by 100% test



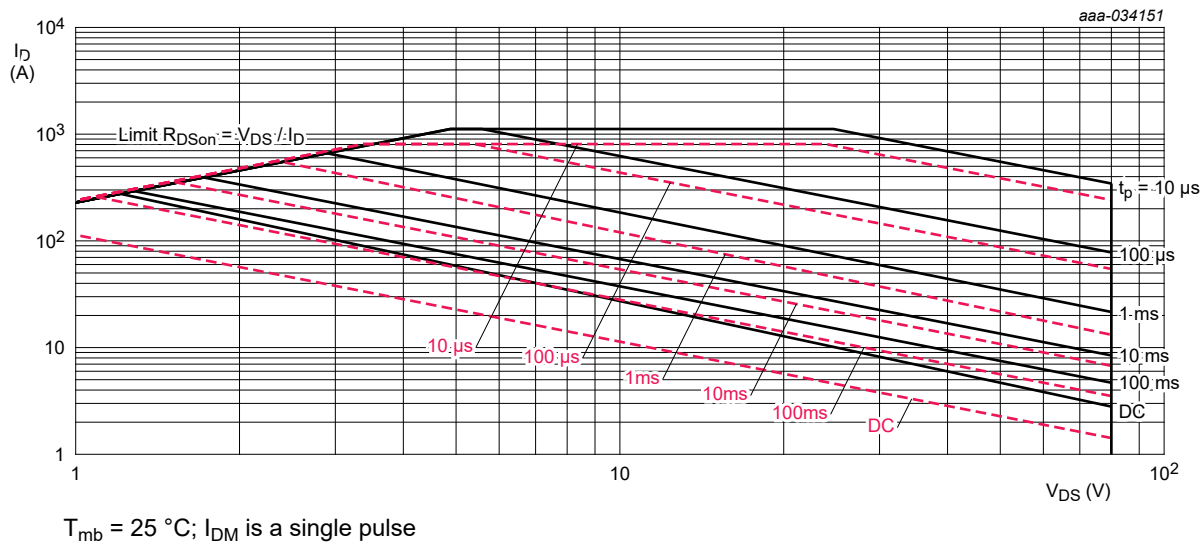


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

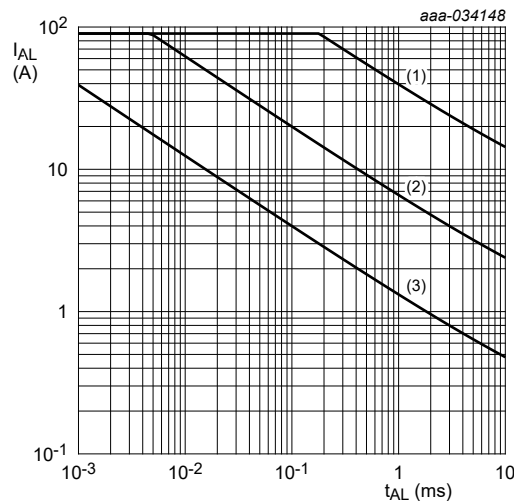


Fig. 4. Avalanche rating; avalanche current as a function of avalanche time

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	-	0.2	0.44	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	Fig. 6	-	35	-	K/W
		Fig. 7	-	70	-	K/W

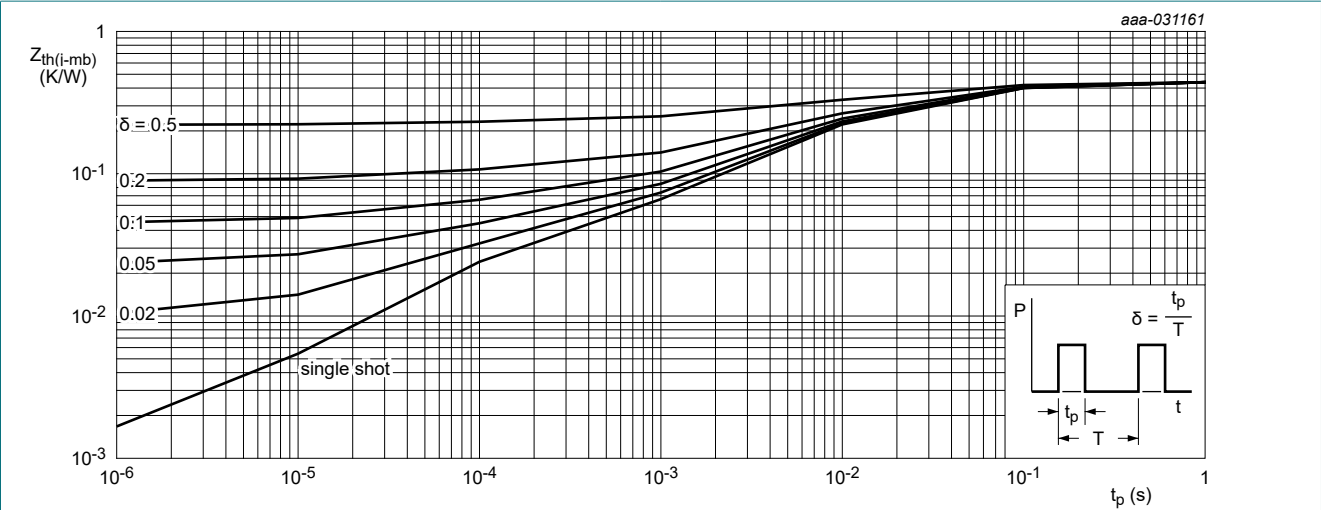


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

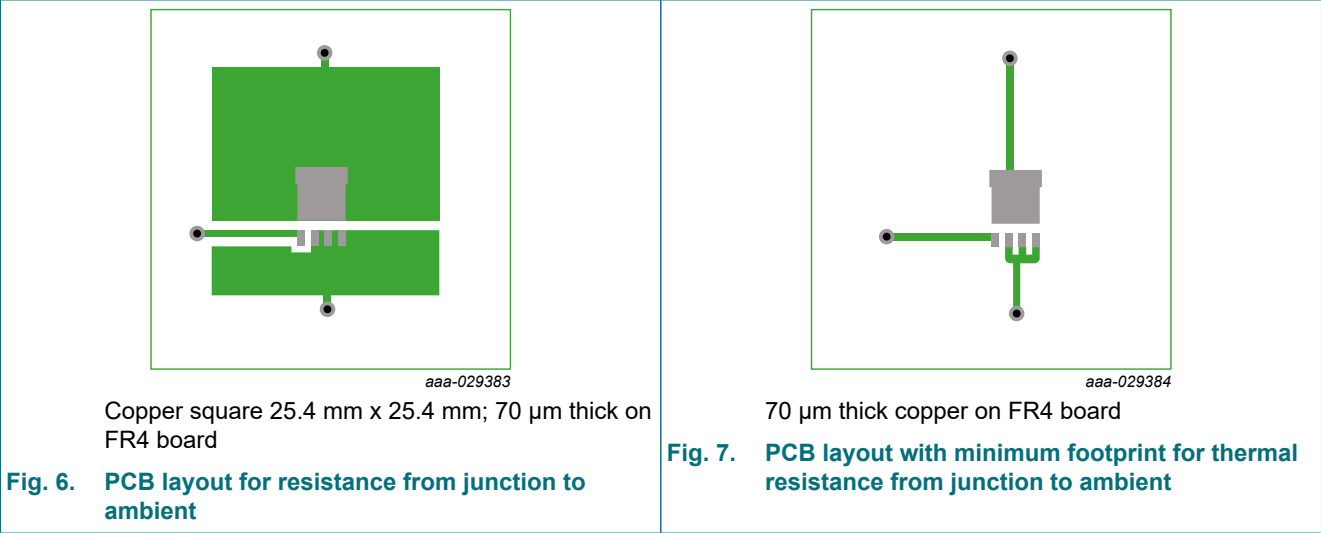


Fig. 6. PCB layout for resistance from junction to ambient

Fig. 7. PCB layout with minimum footprint for thermal resistance from junction to ambient

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	80	-	-	V
		I _D = 250 μA; V _{GS} = 0 V; T _J = -55 °C	72	-	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 1 mA; V _{DS} =V _{GS} ; T _J = 25 °C; Fig. 11	2	2.6	3.6	V
		I _D = 1 mA; V _{DS} =V _{GS} ; T _J = 175 °C	-	1.6	-	V
		I _D = 1 mA; V _{DS} =V _{GS} ; T _J = -55 °C	-	3	-	V
ΔV _{GS(th)} /ΔT	gate-source threshold voltage variation with temperature	25 °C ≤ T _J ≤ 150 °C	-	-6.4	-	mV/K
I _{DSS}	drain leakage current	V _{DS} = 80 V; V _{GS} = 0 V; T _J = 25 °C	-	0.02	1	μA
		V _{DS} = 16 V; V _{GS} = 0 V; T _J = 125 °C	-	3	100	μA
I _{GSS}	gate leakage current	V _{GS} = 20 V; V _{DS} = 0 V; T _J = 25 °C	-	2	100	nA
		V _{GS} = -20 V; V _{DS} = 0 V; T _J = 25 °C	-	2	100	nA

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Symbol	Parameter	Conditions		Min	Typ	Max	Unit
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 25 A; T _j = 25 °C; Fig. 12		-	1.6	1.9	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 100 °C; Fig. 13		-	2.6	3	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 175 °C; Fig. 13		-	-	4.2	mΩ
R _G	gate resistance	f = 1 MHz; T _j = 25 °C		0.8	1.6	3.2	Ω
Dynamic characteristics							
Q _{G(tot)}	total gate charge	I _D = 25 A; V _{DS} = 40 V; V _{GS} = 10 V; T _j = 25 °C; Fig. 14 ; Fig. 15		77	155	232	nC
		I _D = 0 A; V _{DS} = 0 V; V _{GS} = 10 V; T _j = 25 °C; Fig. 14 ; Fig. 15		-	83	-	nC
Q _{GS}	gate-source charge	I _D = 25 A; V _{DS} = 40 V; V _{GS} = 10 V; T _j = 25 °C; Fig. 14 ; Fig. 15		36	60	84	nC
Q _{GS(th)}	pre-threshold gate-source charge			-	34	-	nC
Q _{GS(th-pl)}	post-threshold gate-source charge			-	26	-	nC
Q _{GD}	gate-drain charge			7	23	53	nC
V _{GS(pl)}	gate-source plateau voltage	I _D = 25 A; V _{DS} = 40 V; T _j = 25 °C; Fig. 14 ; Fig. 15		-	5.2	-	V
C _{iss}	input capacitance	V _{DS} = 40 V; V _{GS} = 0 V; f = 0.5 MHz; T _j = 25 °C; Fig. 16		7340	12235	17140	pF
C _{oss}	output capacitance			1710	2843	4560	pF
C _{rss}	reverse transfer capacitance			7	64	169	pF
t _{d(on)}	turn-on delay time	V _{DS} = 40 V; R _L = 1.6 Ω; V _{GS} = 10 V; R _{G(ext)} = 5 Ω; T _j = 25 °C		-	46	-	ns
t _r	rise time			-	42	-	ns
t _{d(off)}	turn-off delay time			-	79	-	ns
t _f	fall time			-	46	-	ns
Source-drain diode							
V _{SD}	source-drain voltage	I _S = 25 A; V _{GS} = 0 V; T _j = 25 °C; Fig. 17		-	0.78	1	V
t _{rr}	reverse recovery time	I _S = 25 A; dI _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 40 V; T _j = 25 °C; Fig. 18		-	54	-	ns
Q _r	recovered charge		[1]	-	60	-	nC

[1] includes capacitive recovery

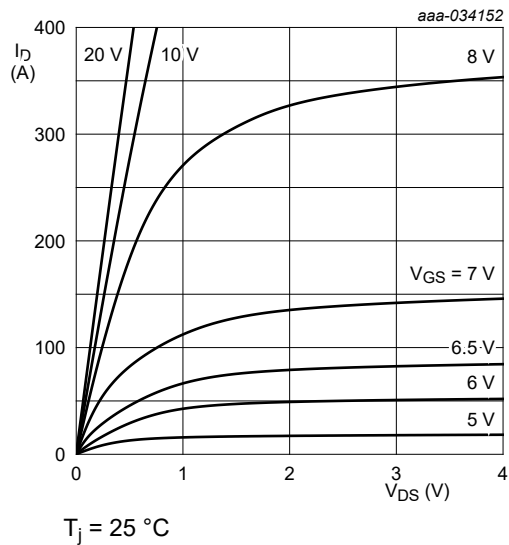


Fig. 8. Output characteristics; drain current as a function of drain-source voltage; typical values

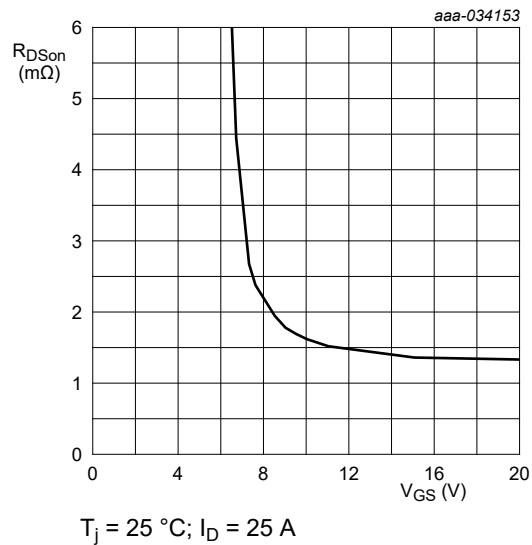


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

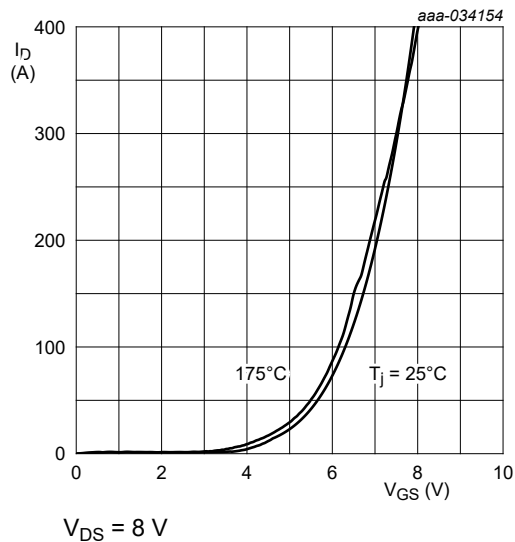


Fig. 10. Transfer characteristics; drain current as a function of gate-source voltage; typical values

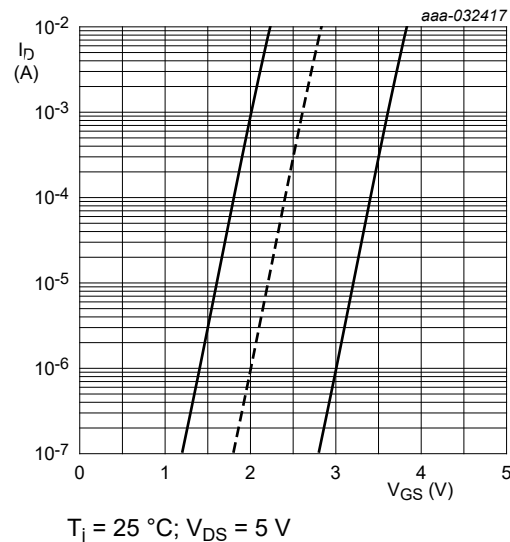


Fig. 11. Sub-threshold drain current as a function of gate-source voltage

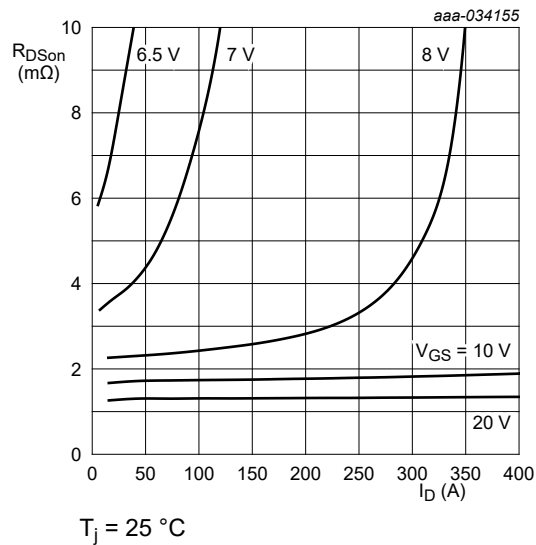


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

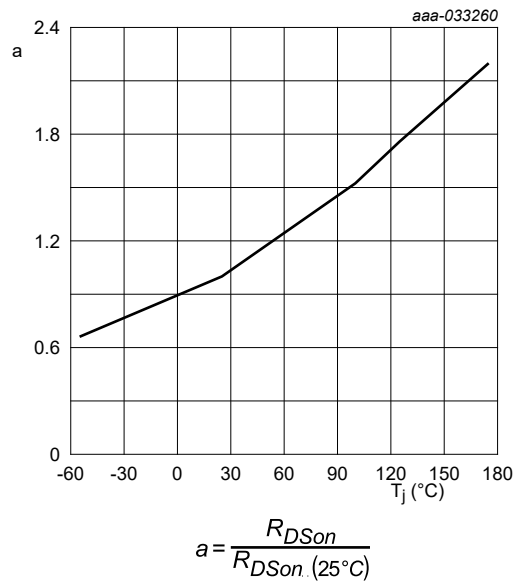


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

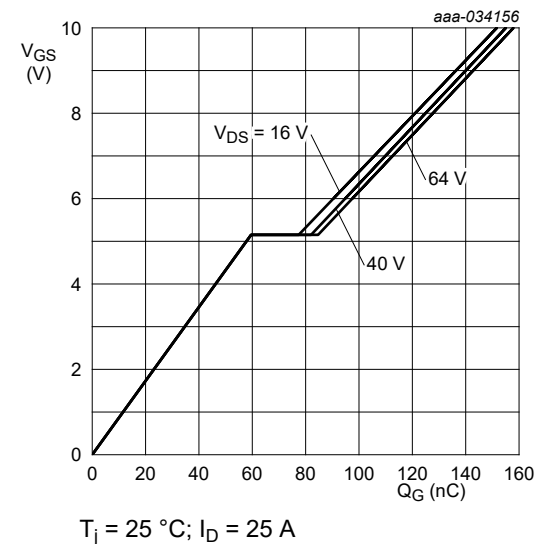


Fig. 14. Gate-source voltage as a function of gate charge; typical values

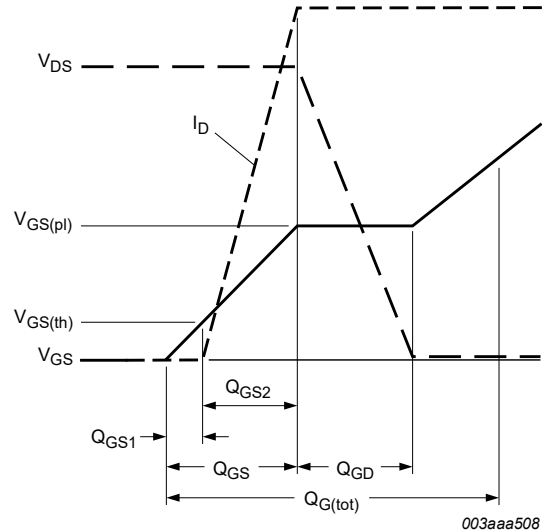
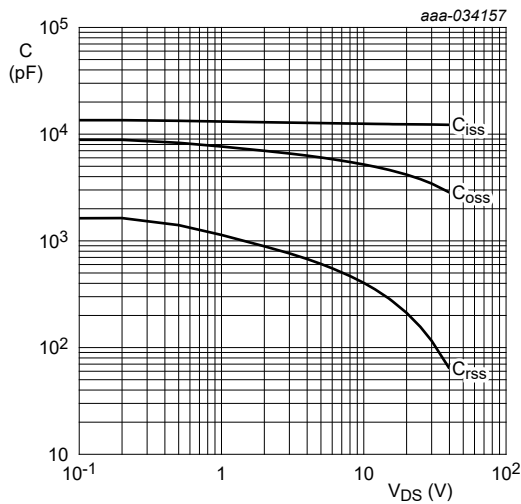
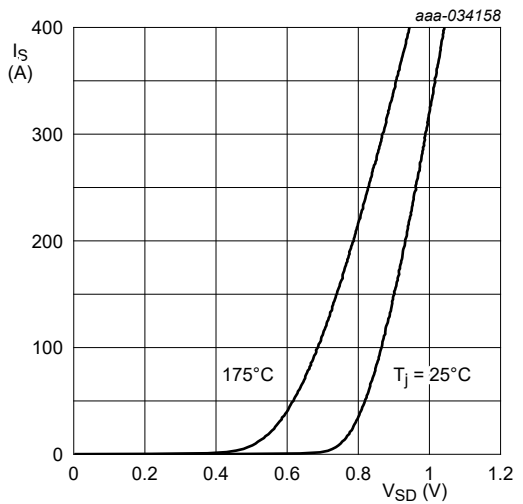


Fig. 15. Gate charge waveform definitions



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

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

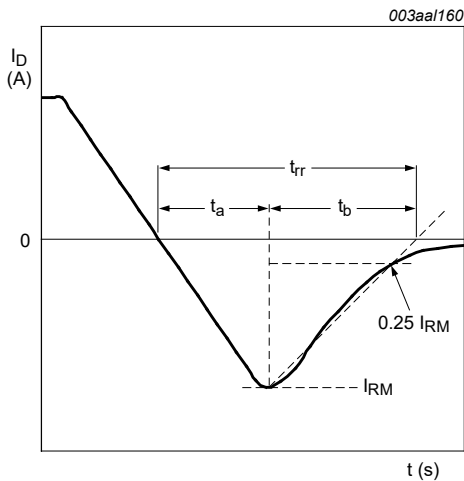


Fig. 18. Reverse recovery timing definition

11. Package outline

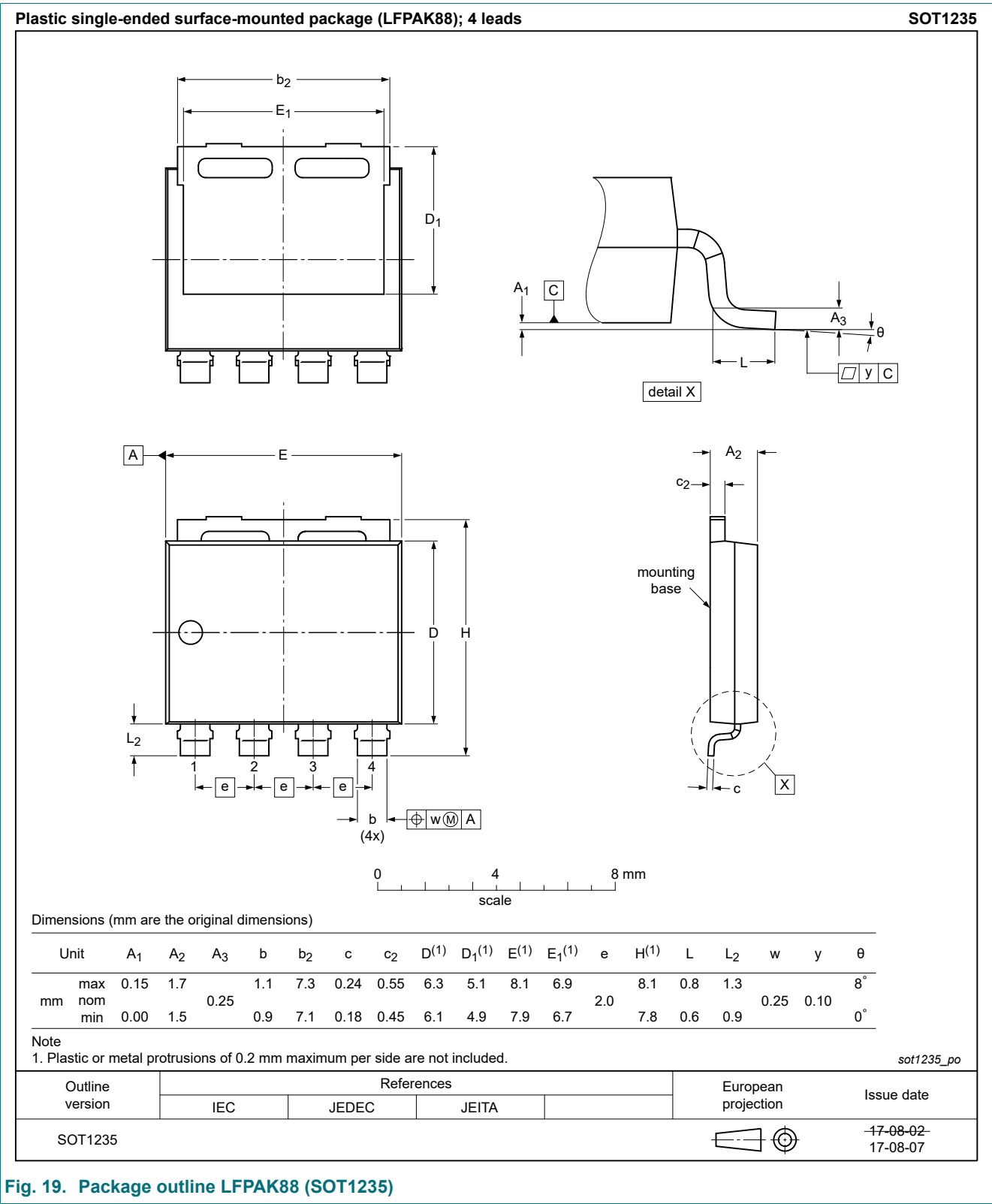


Fig. 19. Package outline LPAK88 (SOT1235)

12. Soldering

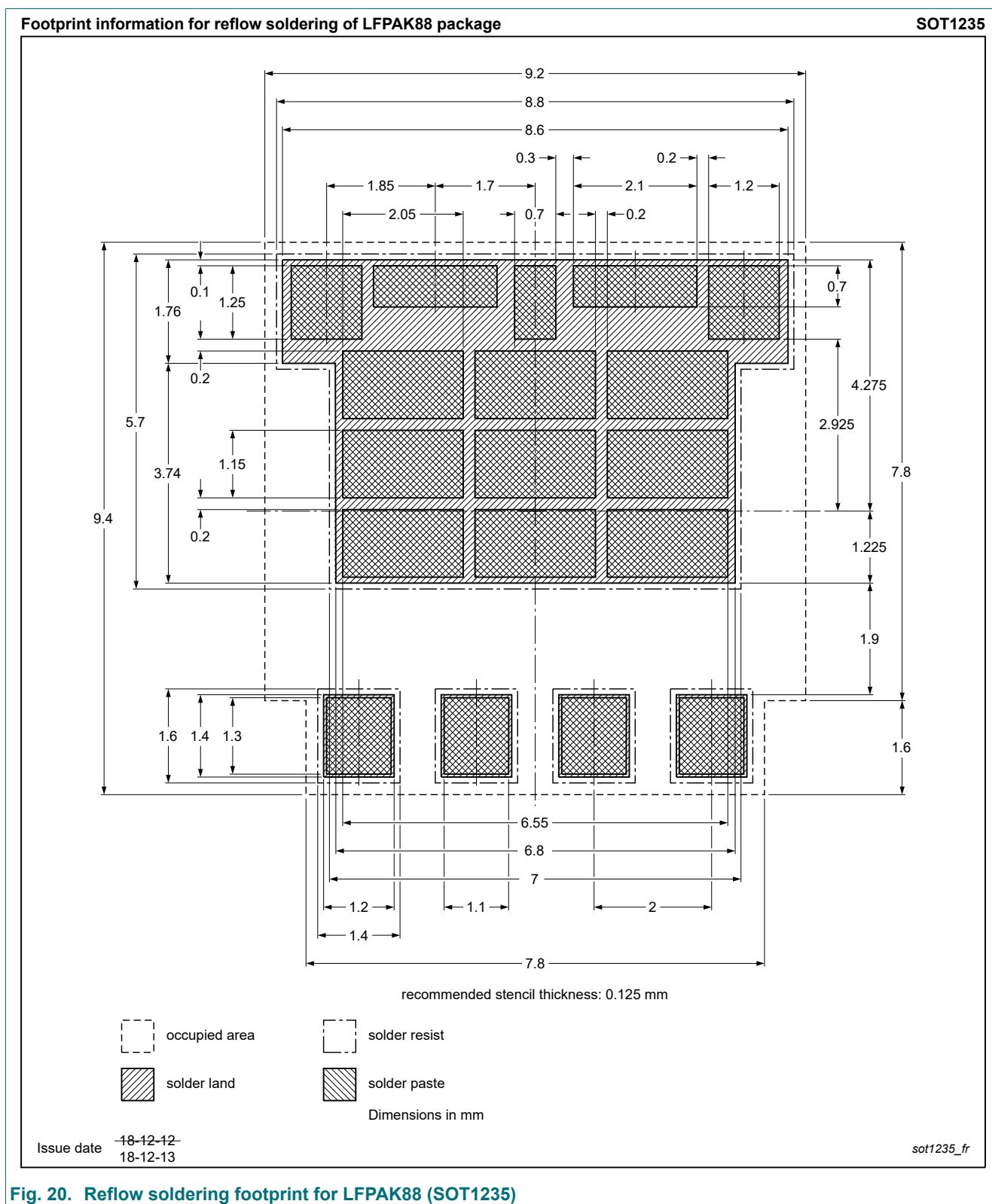


Fig. 20. Reflow soldering footprint for LFPK88 (SOT1235)

13. 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.
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