



PSMN1R9-80SSE

N-channel 80 V, 1.9 mOhm MOSFET with enhanced SOA in LFPAK88

16 December 2022

Product data sheet

1. General description

N-channel enhancement mode MOSFET in a LFPAK88 package qualified to 175 °C. Part of Nexperia's "ASFETs for hotswap" portfolio, the PSMN1R9-80SSE delivers very low $R_{DS(on)}$ and a very strong linear-mode (SOA) performance in a high-reliability copper-clip LFPAK88 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
- LFPAK88 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	$25\text{ °C} \leq T_j \leq 175\text{ °C}$	-	-	80	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; Fig. 2	-	-	286	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Fig. 1	-	-	340	W
T_j	junction temperature		-55	-	175	°C
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; Fig. 12	-	1.6	1.9	mΩ
		$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 100\text{ °C}$; Fig. 13	-	2.6	3	mΩ
Dynamic characteristics						
Q_{GD}	gate-drain charge	$I_D = 25\text{ A}$; $V_{DS} = 40\text{ V}$; $V_{GS} = 10\text{ V}$; $T_j = 25\text{ °C}$; Fig. 14 ; Fig. 15	7	23	53	nC
$Q_{G(tot)}$	total gate charge		77	155	232	nC
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 90\text{ A}$; $V_{sup} \leq 80\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 10\text{ V}$; $T_{j(init)} = 25\text{ °C}$; unclamped; $t_p = 179\text{ }\mu\text{s}$; Fig. 4	[1]	-	840	mJ

N-channel 80 V, 1.9 mOhm MOSFET with enhanced SOA in LFPAK88

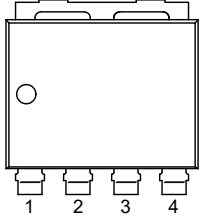
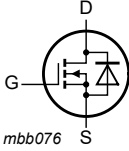
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
Q_r	recovered charge	$I_S = 25 \text{ A}$; $di_S/dt = -100 \text{ A}/\mu\text{s}$; $V_{GS} = 0 \text{ V}$; $V_{DS} = 40 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$; Fig. 18	[2]	-	60	- nC

[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	 <p>LFPAK88 (SOT1235)</p>	 <p>mbb076</p>
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		Version
	Name	Description	
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

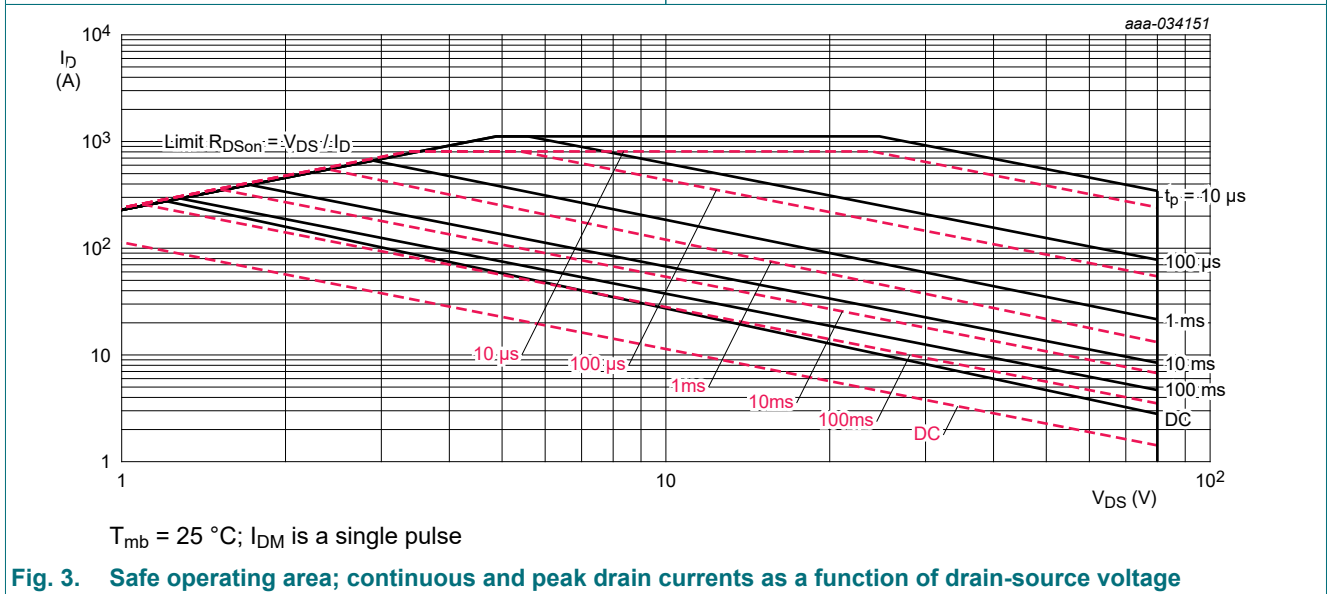
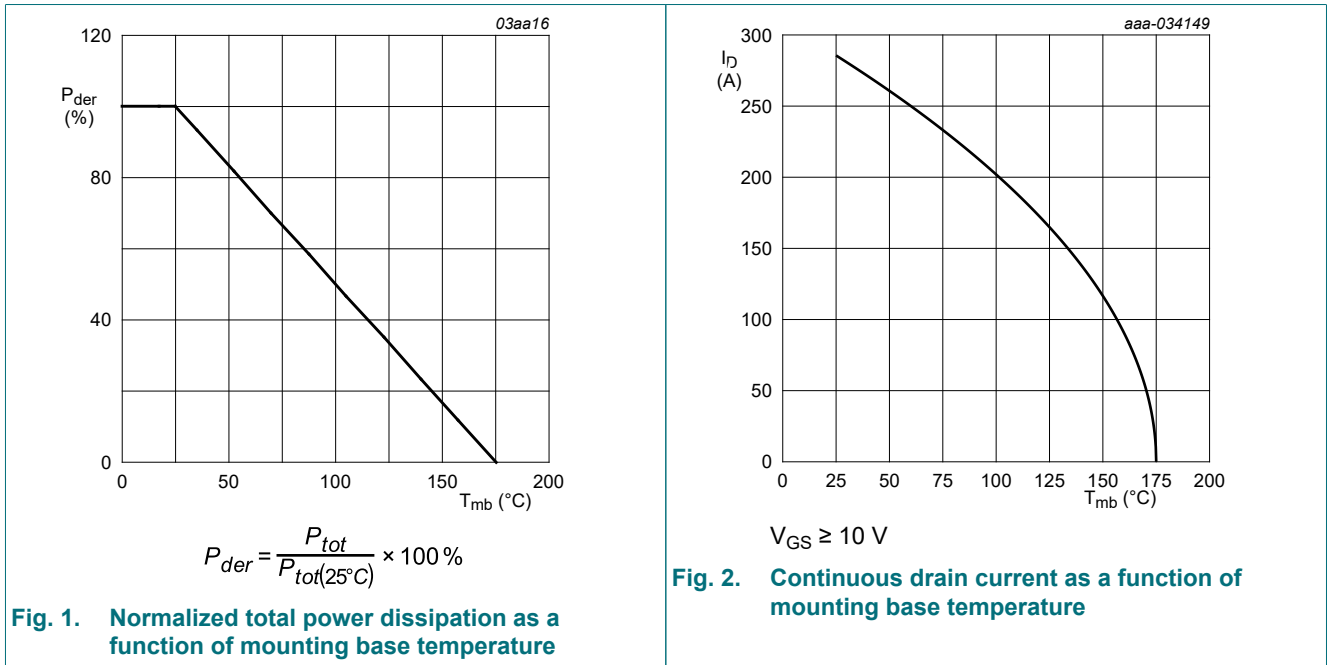
Table 5. Limiting values

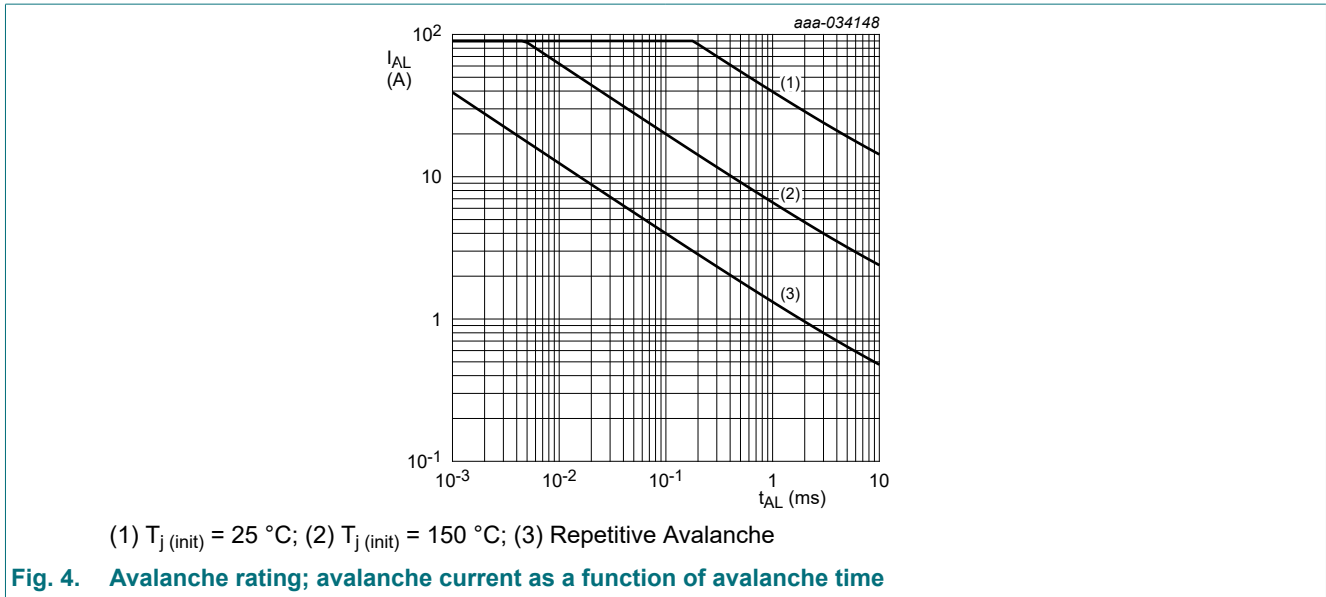
In accordance with the Absolute Maximum Rating System (IEC 60134).

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
I_D	drain current	$V_{GS} = 10 \text{ V}$; $T_{mb} = 25 \text{ }^\circ\text{C}$; Fig. 2	-	286	A
		$V_{GS} = 10 \text{ V}$; $T_{mb} = 100 \text{ }^\circ\text{C}$; Fig. 2	-	202	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10 \text{ }\mu\text{s}$; $T_{mb} = 25 \text{ }^\circ\text{C}$; Fig. 3	-	1142	A
T_{stg}	storage temperature		-55	175	$^\circ\text{C}$

Symbol	Parameter	Conditions	Min	Max	Unit	
T_j	junction temperature		-55	175	°C	
$T_{slid(M)}$	peak soldering temperature		-	260	°C	
Source-drain diode						
I_S	source current	$T_{mb} = 25\text{ °C}$	-	286	A	
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$	-	1142	A	
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 90\text{ A}$; $V_{sup} \leq 80\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 10\text{ V}$; $T_{j(init)} = 25\text{ °C}$; unclamped; $t_p = 179\text{ }\mu\text{s}$; Fig. 4	[1]	-	840	mJ
I_{AS}	non-repetitive avalanche current	$V_{sup} = 80\text{ V}$; $V_{GS} = 10\text{ V}$; $T_{j(init)} = 25\text{ °C}$; $R_{GS} = 50\text{ }\Omega$; Fig. 4	[1]	-	90	A

[1] Protected by 100% test

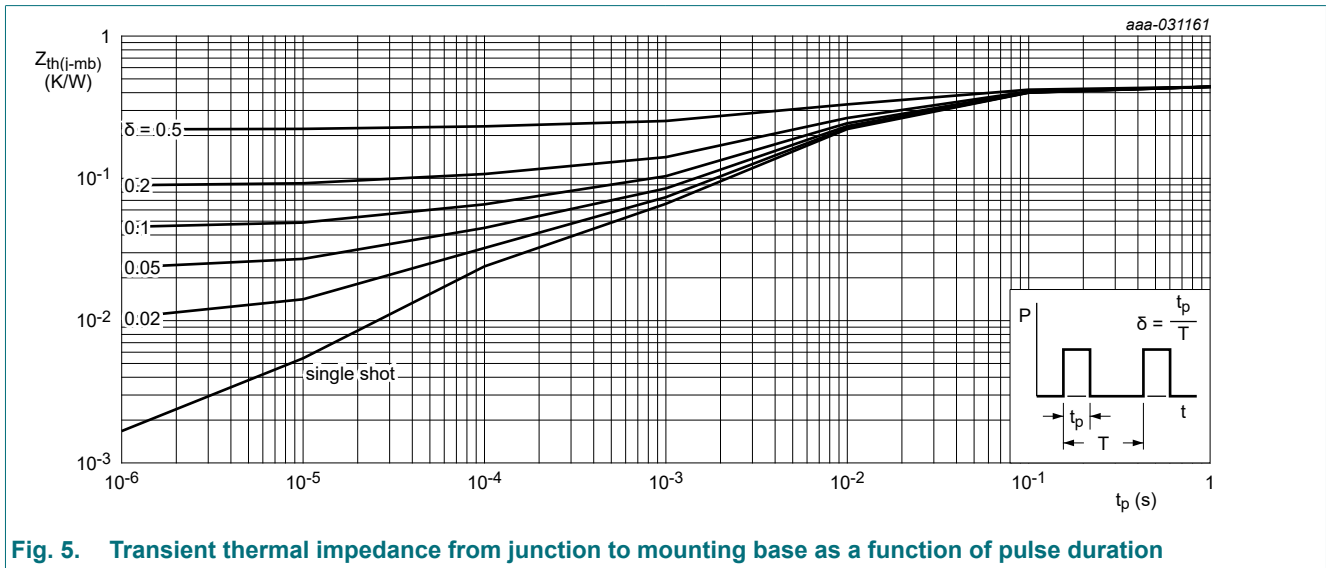


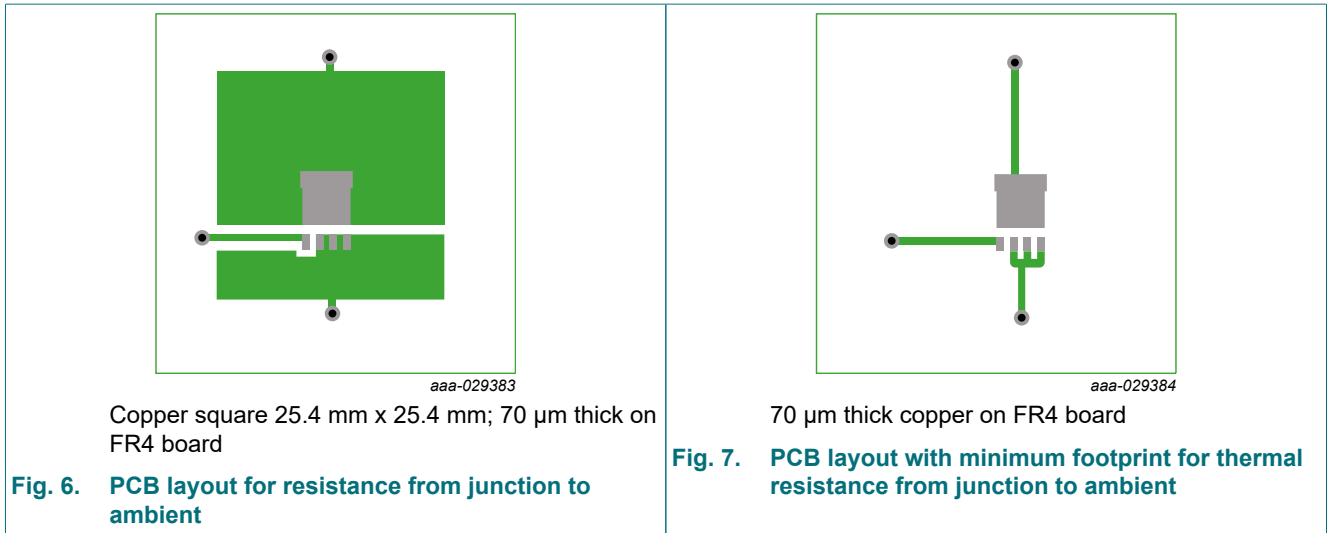


9. Thermal characteristics

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 Fig. 7	-	35	-	K/W
			-	70	-	K/W





10. Characteristics

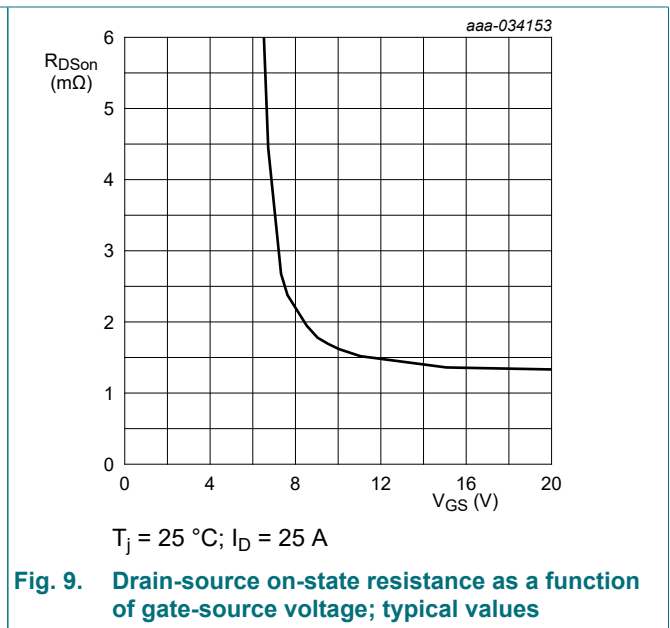
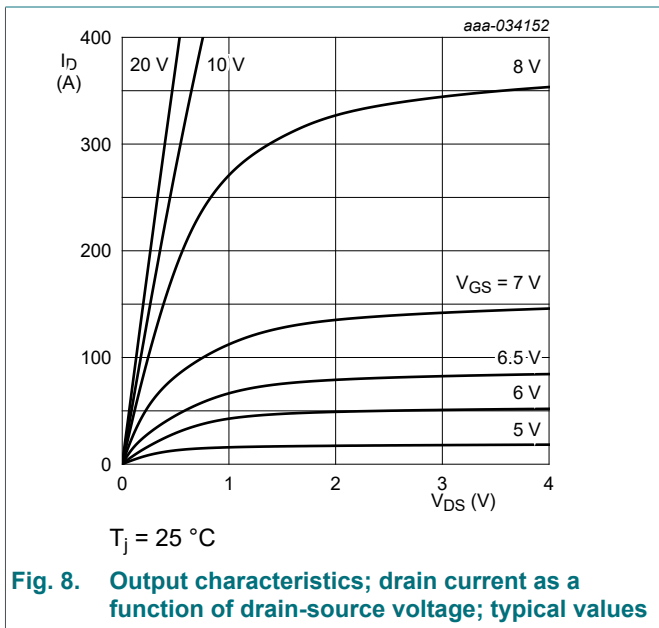
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	80	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	72	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = 25 \text{ }^\circ C; \text{ Fig. 11}$	2	2.6	3.6	V
		$I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = 175 \text{ }^\circ C$	-	1.6	-	V
		$I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = -55 \text{ }^\circ C$	-	3	-	V
$\Delta V_{GS(th)}/\Delta T$	gate-source threshold voltage variation with temperature	$25 \text{ }^\circ C \leq T_j \leq 150 \text{ }^\circ C$	-	-6.4	-	mV/K
I_{DSS}	drain leakage current	$V_{DS} = 80 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	0.02	1	μA
		$V_{DS} = 16 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ C$	-	3	100	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	2	100	nA
		$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ C; \text{ Fig. 12}$	-	1.6	1.9	m Ω
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 100 \text{ }^\circ C; \text{ Fig. 13}$	-	2.6	3	m Ω
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ C; \text{ Fig. 13}$	-	-	4.2	m Ω
R_G	gate resistance	$f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ C$	0.8	1.6	3.2	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 25 \text{ A}; V_{DS} = 40 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ C; \text{ Fig. 14}; \text{ Fig. 15}$	77	155	232	nC
		$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ C; \text{ Fig. 14}; \text{ Fig. 15}$	-	83	-	nC

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Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Q_{GS}	gate-source charge	$I_D = 25\text{ A}; V_{DS} = 40\text{ V}; V_{GS} = 10\text{ V}; T_j = 25\text{ }^\circ\text{C};$ 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	$I_D = 25\text{ A}; V_{DS} = 40\text{ V}; T_j = 25\text{ }^\circ\text{C};$ Fig. 14; Fig. 15	-	5.2	-	V
C_{iss}	input capacitance	$V_{DS} = 40\text{ V}; V_{GS} = 0\text{ V}; f = 0.5\text{ MHz}; T_j = 25\text{ }^\circ\text{C};$ 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	$V_{DS} = 40\text{ V}; R_L = 1.6\text{ }\Omega; V_{GS} = 10\text{ V}; R_{G(ext)} = 5\text{ }\Omega; T_j = 25\text{ }^\circ\text{C}$	-	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	$I_S = 25\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C};$ Fig. 17	-	0.78	1	V
t_{rr}	reverse recovery time	$I_S = 25\text{ A}; di_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V};$	-	54	-	ns
Q_r	recovered charge	$V_{DS} = 40\text{ V}; T_j = 25\text{ }^\circ\text{C};$ Fig. 18	[1]	60	-	nC

[1] includes capacitive recovery



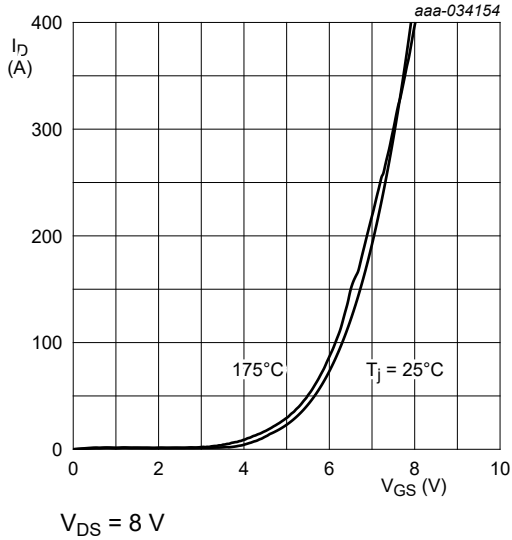


Fig. 10. Transfer characteristics; drain current as a function of gate-source voltage; typical values

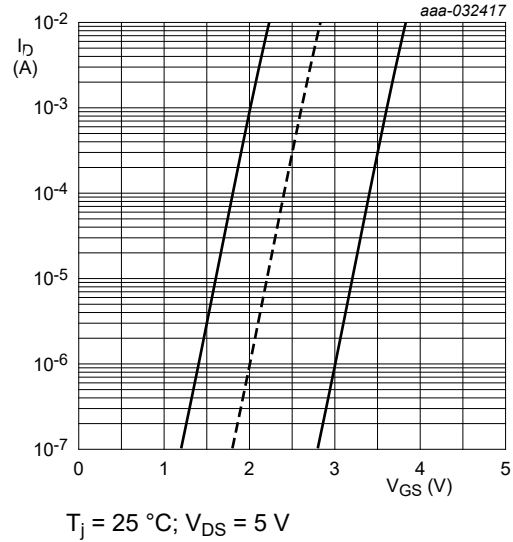


Fig. 11. Sub-threshold drain current as a function of gate-source voltage

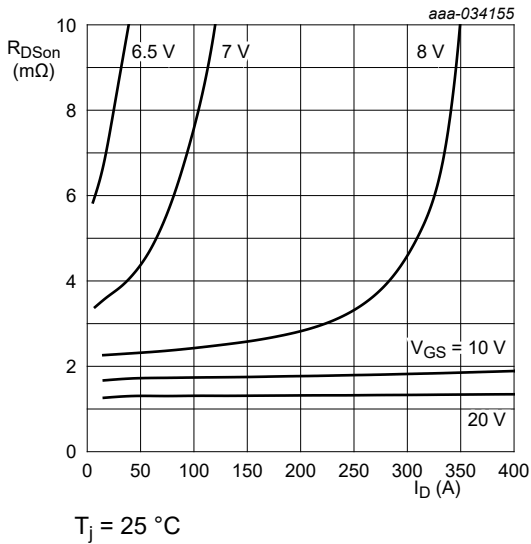


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

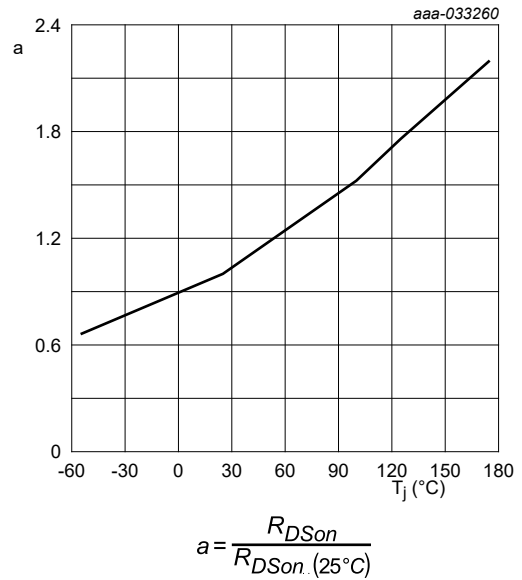
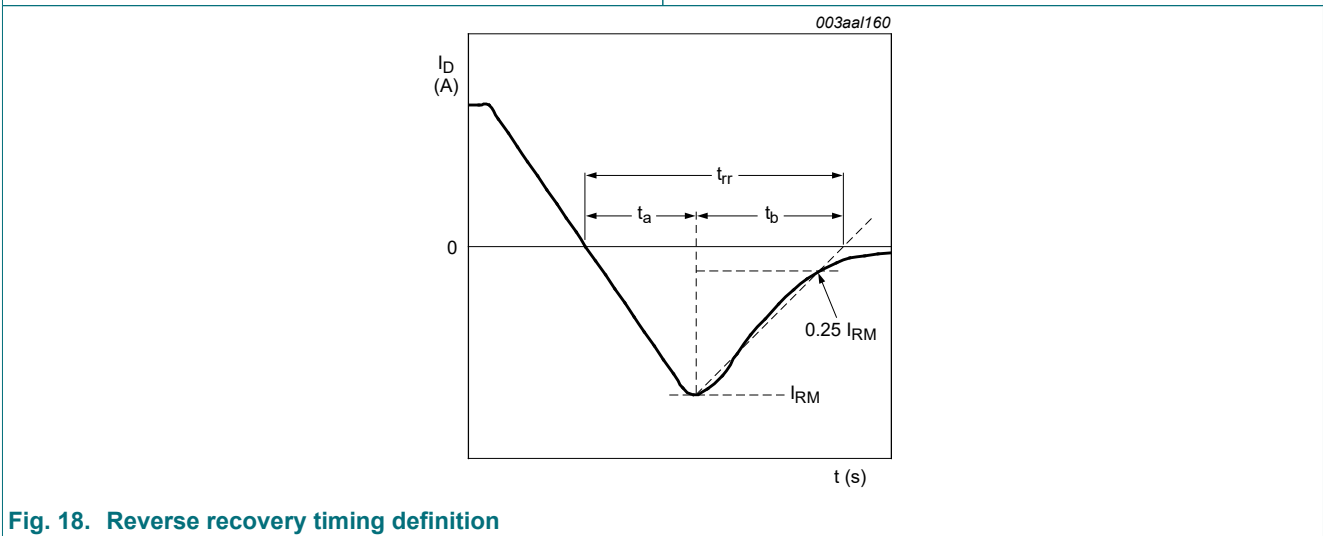
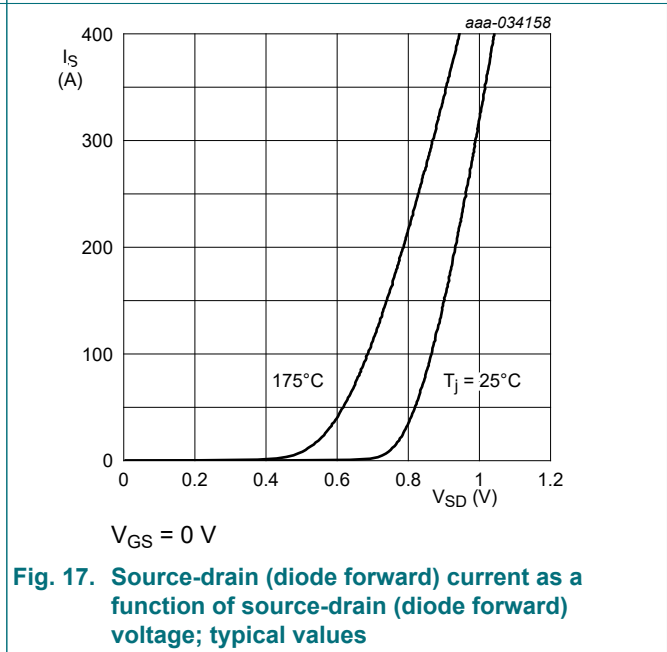
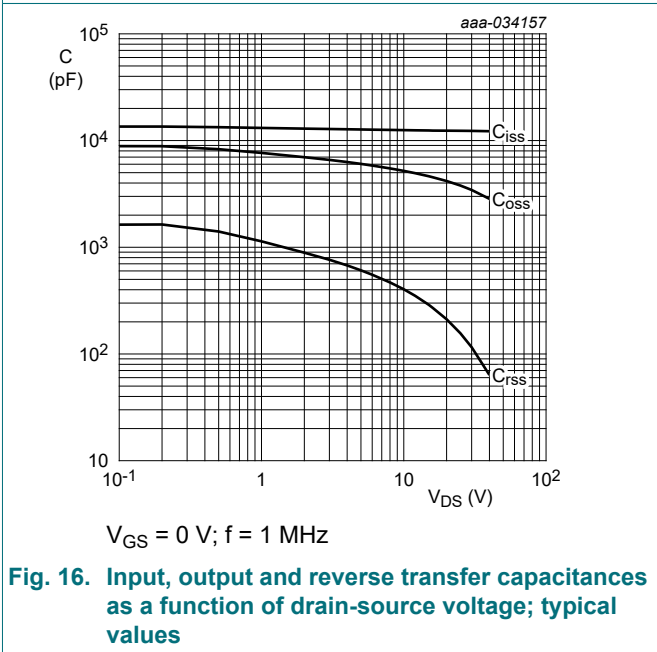
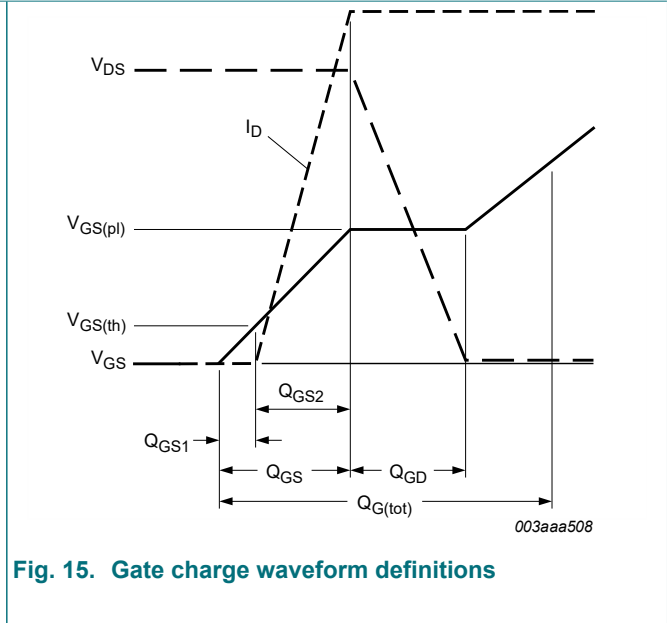
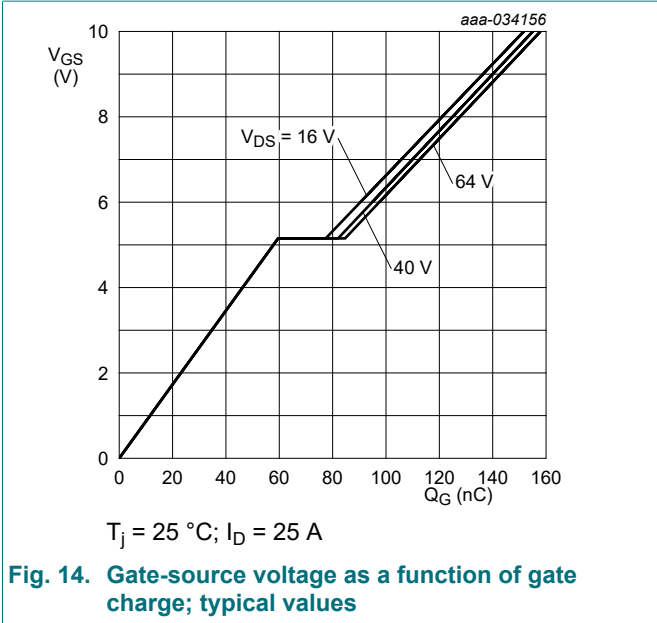


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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



11. Package outline

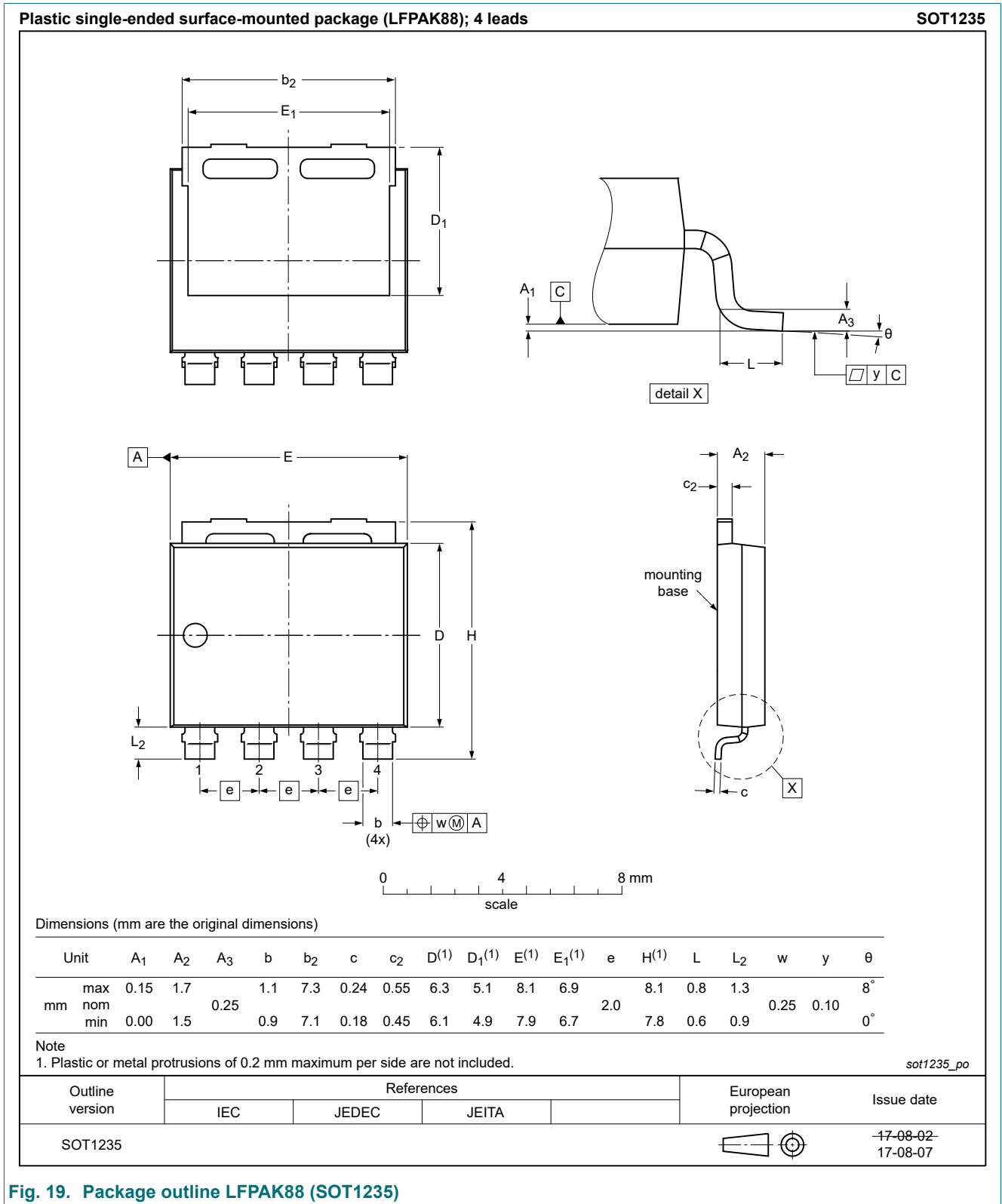


Fig. 19. Package outline LPAK88 (SOT1235)

12. Soldering

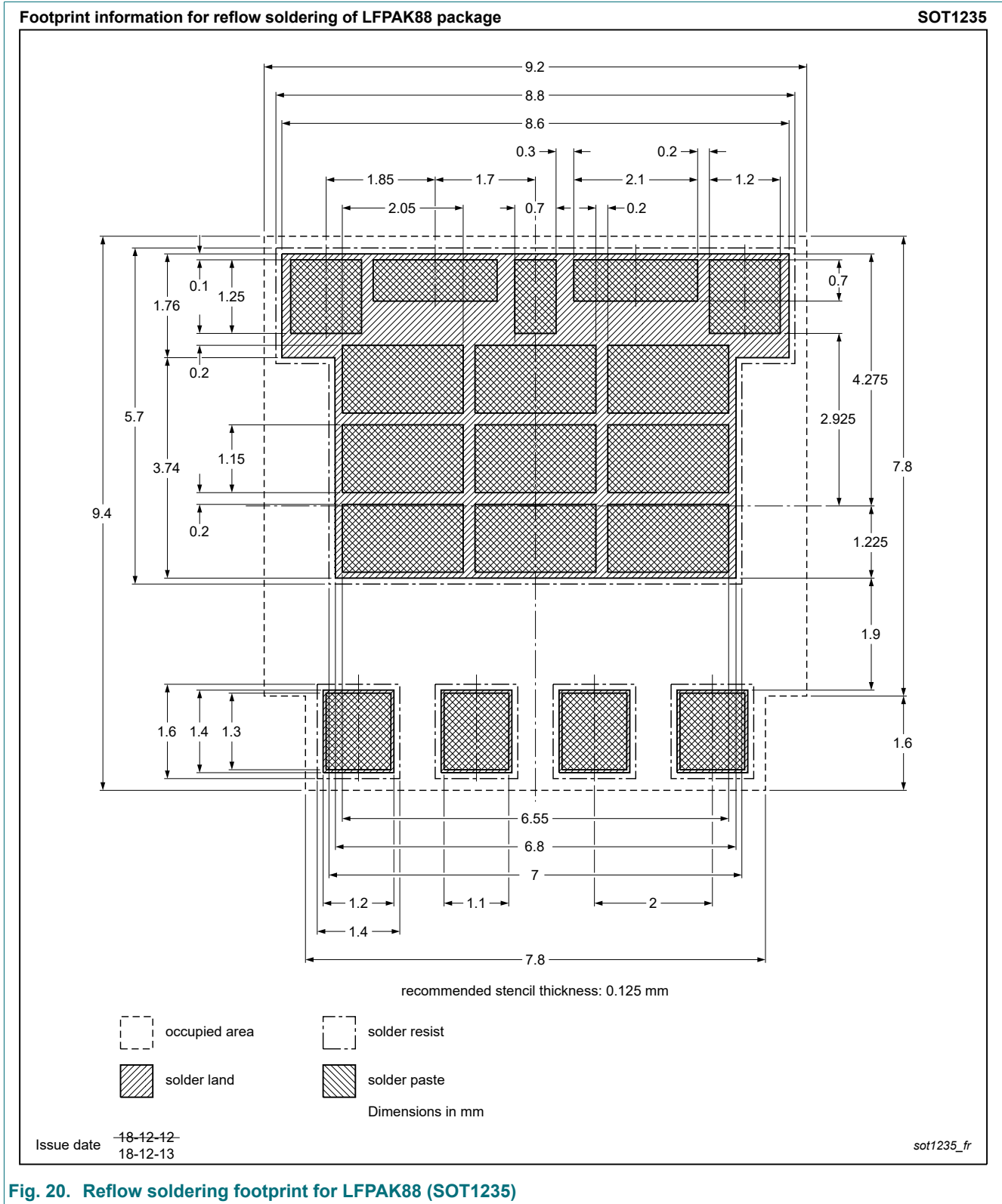


Fig. 20. Reflow soldering footprint for LPAK88 (SOT1235)

13. Legal information

Data sheet status

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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