



# PSMN1R2-30YLD

N-channel 30 V, 1.2 m $\Omega$ , 250 A logic level MOSFET in LPAK56 using NextPowerS3 Technology

21 December 2018

Product data sheet

## 1. General description

250 A logic level gate drive N-channel enhancement mode MOSFET in LPAK56 package. NextPowerS3 portfolio utilising Nexperia's unique "SchottkyPlus" technology delivers high efficiency, low spiking performance usually associated with MOSFETs with an integrated Schottky or Schottky-like diode but without problematic high leakage current. NextPowerS3 is particularly suited to high efficiency applications at high switching frequencies.

## 2. Features and benefits

- 250 A capability
- Ultra low  $Q_G$ ,  $Q_{GD}$  and  $Q_{OSS}$  for high system efficiency, especially at higher switching frequencies
- Superfast switching with soft-recovery; s-factor > 1
- Low spiking and ringing for low EMI designs
- Unique "SchottkyPlus" technology; Schottky-like performance with < 1  $\mu$ A leakage at 25 °C
- Optimised for 4.5 V gate drive
- Low parasitic inductance and resistance
- High reliability clip bonded and solder die attach Power SO8 package; no glue, no wire bonds, qualified to 175 °C
- Wave solderable; exposed leads for optimal visual solder inspection

## 3. Applications

- On-board DC-to-DC solutions for server and telecommunications
- Secondary-side synchronous rectification in telecommunication applications
- Voltage regulator modules (VRM)
- Point-of-Load (POL) modules
- Power delivery for V-core, ASIC, DDR, GPU, VGA and system components
- Brushed and brushless motor control
- Power OR-ing

## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	25 °C $\leq$ $T_j$ $\leq$ 175 °C	-	-	30	V
$I_D$	drain current	$V_{GS} = 10$ V; $T_{mb} = 25$ °C; <a href="#">Fig. 2</a>	[1]	-	250	A
$P_{tot}$	total power dissipation	$T_{mb} = 25$ °C; <a href="#">Fig. 1</a>	-	-	194	W
$T_j$	junction temperature		-55	-	175	°C
<b>Static characteristics</b>						
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 4.5$ V; $I_D = 25$ A; $T_j = 25$ °C; <a href="#">Fig. 10</a>	-	1.2	1.6	m $\Omega$

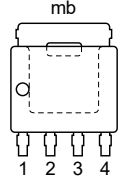
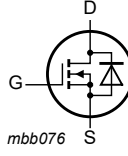
N-channel 30 V, 1.2 mΩ, 250 A logic level MOSFET in LFPAK56 using NextPowerS3 Technology

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		$V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 10</a>	-	0.96	1.24	mΩ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$I_D = 25\text{ A}$ ; $V_{DS} = 15\text{ V}$ ; $V_{GS} = 4.5\text{ V}$ ; <a href="#">Fig. 12</a> ; <a href="#">Fig. 13</a>	-	9.1	-	nC
$Q_{G(tot)}$	total gate charge		-	32	-	nC
<b>Source-drain diode</b>						
S	softness factor	$I_S = 25\text{ A}$ ; $di_S/dt = -100\text{ A}/\mu\text{s}$ ; $V_{GS} = 0\text{ V}$ ; $V_{DS} = 15\text{ V}$ ; <a href="#">Fig. 16</a>	-	0.95	-	

[1] 250A continuous current has been successfully demonstrated during application test. Practically, the current will be limited by PCB, thermal design and operating temperature.

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 <p>LFPAK56; Power-SO8 (SOT669)</p>	 <p>mbb076</p>
2	S	source		
3	S	source		
4	G	gate		
mb	D	mounting base; connected to drain		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PSMN1R2-30YLD	LFPAK56; Power-SO8	Plastic single-ended surface-mounted package (LFPAK56; Power-SO8); 4 leads	SOT669

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN1R2-30YLD	1D230L

## 8. Limiting values

Table 5. Limiting values

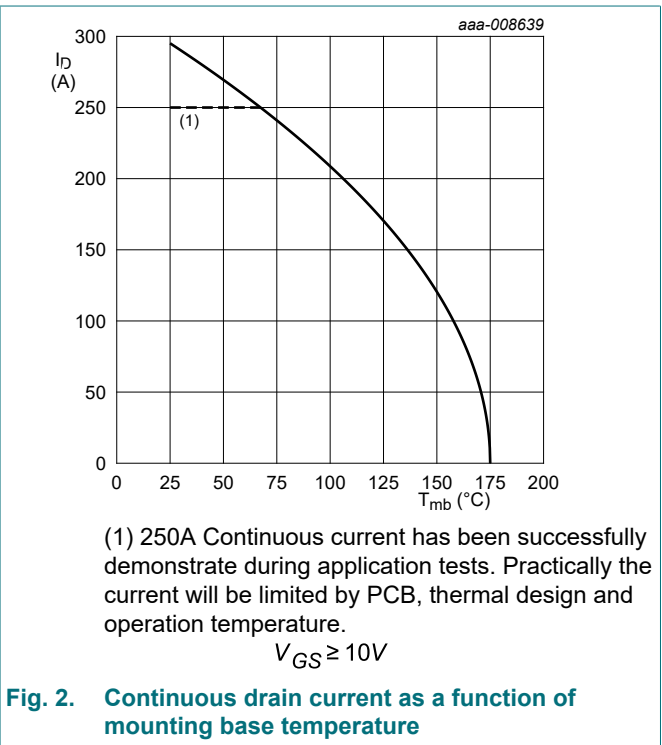
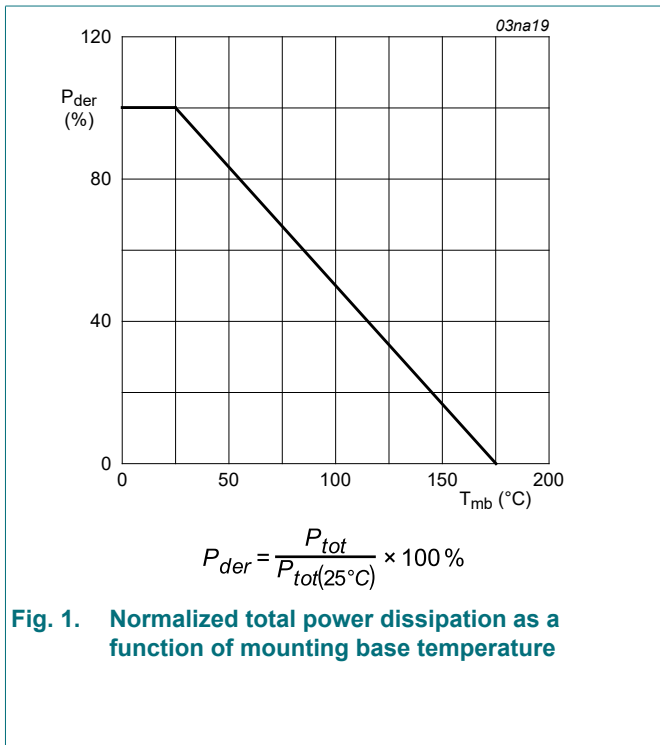
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$	-	30	V
$V_{DGR}$	drain-gate voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$ ; $R_{GS} = 20\text{ k}\Omega$	-	30	V
$V_{GS}$	gate-source voltage		-20	20	V
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 1</a>	-	194	W

N-channel 30 V, 1.2 mΩ, 250 A logic level MOSFET in LPAK56 using NextPowerS3 Technology

Symbol	Parameter	Conditions		Min	Max	Unit
I <sub>D</sub>	drain current	V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 25 °C; Fig. 2	[1]	-	250	A
		V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 100 °C; Fig. 2		-	209	A
I <sub>DM</sub>	peak drain current	pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C; Fig. 3		-	1181	A
T <sub>stg</sub>	storage temperature			-55	175	°C
T <sub>j</sub>	junction temperature			-55	175	°C
T <sub>slid(M)</sub>	peak soldering temperature			-	260	°C
V <sub>ESD</sub>	electrostatic discharge voltage	HBM		1500	-	V
<b>Source-drain diode</b>						
I <sub>S</sub>	source current	T <sub>mb</sub> = 25 °C		-	162	A
I <sub>SM</sub>	peak source current	pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C		-	1181	A
<b>Avalanche ruggedness</b>						
E <sub>DS(AL)S</sub>	non-repetitive drain-source avalanche energy	I <sub>D</sub> = 25 A; V <sub>sup</sub> ≤ 30 V; R <sub>GS</sub> = 50 Ω; V <sub>GS</sub> = 10 V; T <sub>j(init)</sub> = 25 °C; unclamped; t <sub>p</sub> = 1.97 ms	[2]	-	961	mJ

- [1] 250A continuous current has been successfully demonstrated during application test. Practically, the current will be limited by PCB, thermal design and operating temperature.
- [2] Protected by 100% test



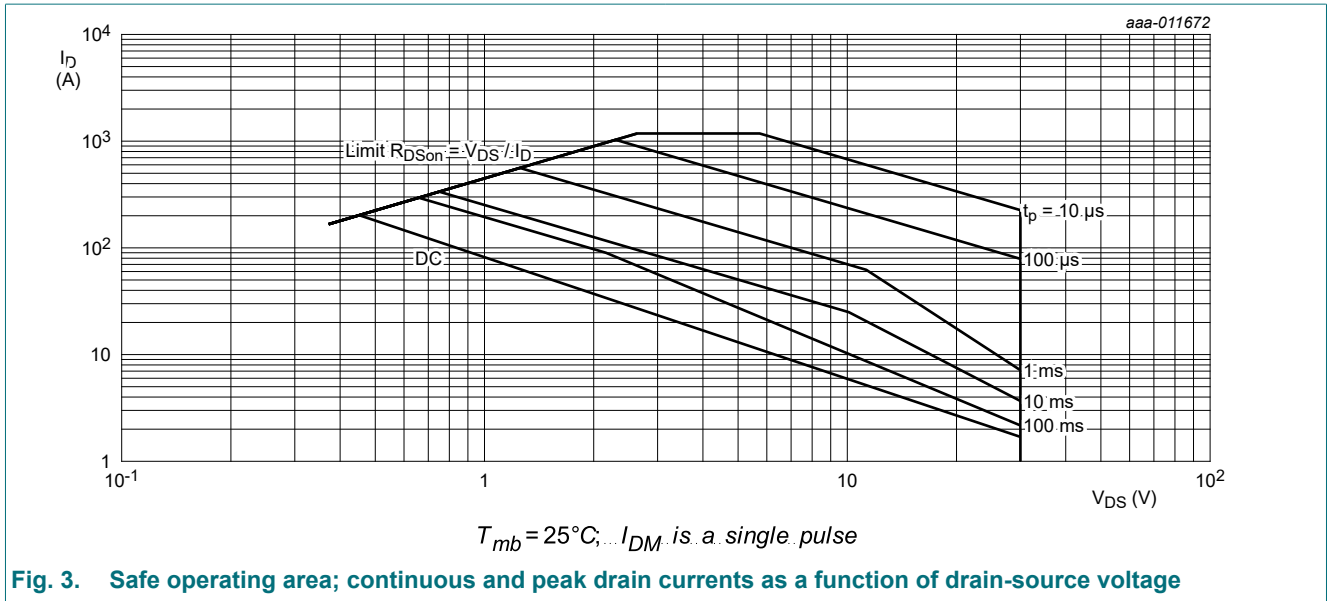


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

### 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	-	0.69	0.77	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	Fig. 5	-	50	-	K/W
		Fig. 6	-	125	-	K/W

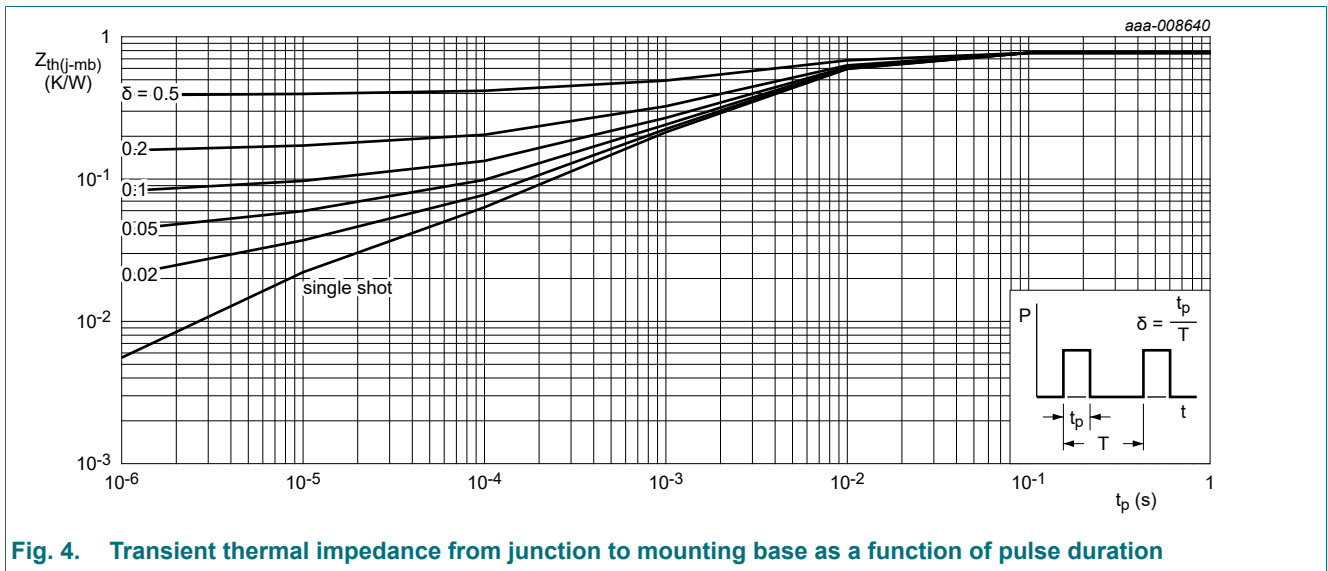
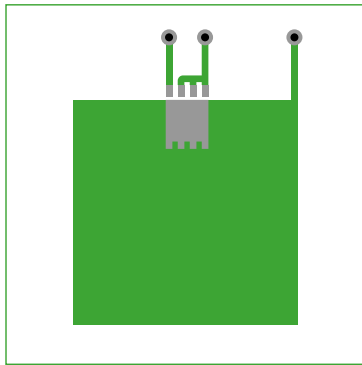
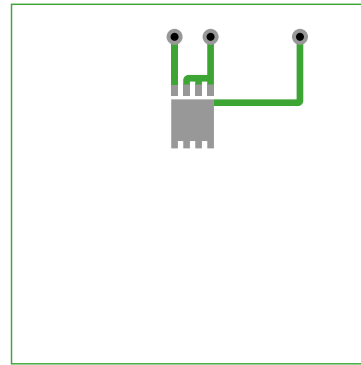


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration



aaa-005750

Fig. 5. PCB layout for thermal resistance junction to ambient 1" square pad; FR4 Board; 2oz copper



aaa-005751

Fig. 6. PCB layout for thermal resistance junction to ambient minimum footprint;FR4 board; 2oz copper

## 10. Characteristics

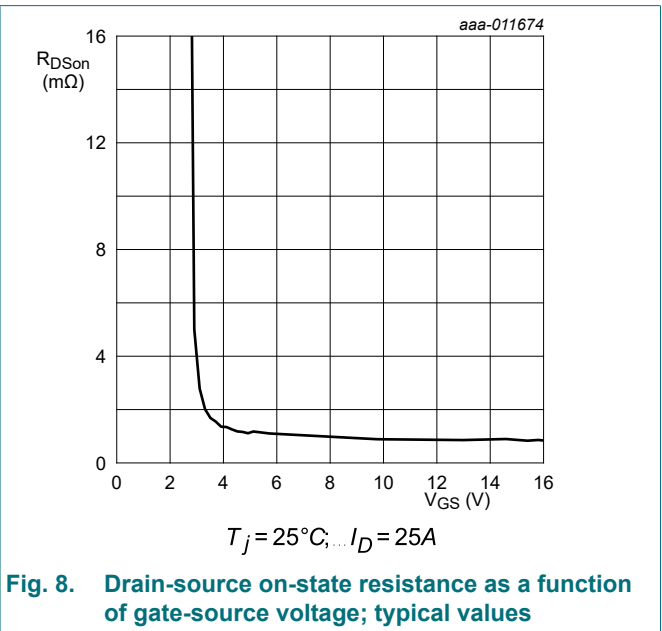
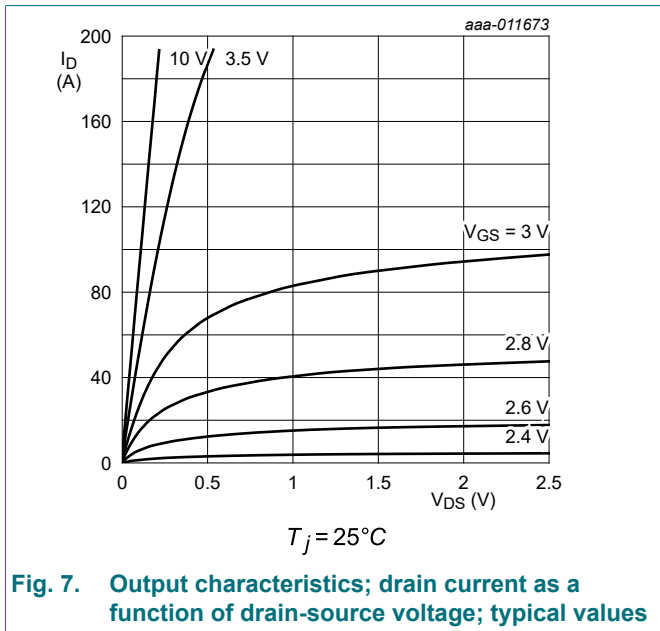
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	30	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	27	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 2 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C$	1.2	1.7	2.2	V
$\Delta V_{GS(th)}/\Delta T$	gate-source threshold voltage variation with temperature	$25 \text{ }^\circ C \leq T_j \leq 150 \text{ }^\circ C$	-	-4.7	-	mV/K
$I_{DSS}$	drain leakage current	$V_{DS} = 24 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	-	1	$\mu A$
		$V_{DS} = 24 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ C$	-	1.9	-	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 16 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	-	100	nA
		$V_{GS} = -16 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ C;$ <a href="#">Fig. 10</a>	-	1.2	1.6	mΩ
		$V_{GS} = 4.5 \text{ V}; I_D = 25 \text{ A}; T_j = 150 \text{ }^\circ C;$ <a href="#">Fig. 10; Fig. 11</a>	-	-	2.64	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ C;$ <a href="#">Fig. 10</a>	-	0.96	1.24	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 150 \text{ }^\circ C;$ <a href="#">Fig. 10; Fig. 11</a>	-	-	2.05	mΩ
$R_G$	gate resistance	$f = 1 \text{ MHz}$	-	1.15	-	Ω
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 25 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 10 \text{ V};$ <a href="#">Fig. 12; Fig. 13</a>	-	68	-	nC
		$I_D = 25 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 4.5 \text{ V};$ <a href="#">Fig. 12; Fig. 13</a>	-	32	-	nC
		$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$	-	62	-	nC
$Q_{GS}$	gate-source charge	$I_D = 25 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 4.5 \text{ V};$ <a href="#">Fig. 12; Fig. 13</a>	-	9.9	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	6.4	-	nC

N-channel 30 V, 1.2 mΩ, 250 A logic level MOSFET in LPAK56 using NextPowerS3 Technology

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	3.5	-	nC
$Q_{GD}$	gate-drain charge		-	9.1	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 25\text{ A}$ ; $V_{DS} = 15\text{ V}$ ; Fig. 12; Fig. 13	-	2.5	-	V
$C_{iss}$	input capacitance	$V_{DS} = 15\text{ V}$ ; $V_{GS} = 0\text{ V}$ ; $f = 1\text{ MHz}$ ; $T_j = 25\text{ °C}$ ; Fig. 14	-	4616	-	pF
$C_{oss}$	output capacitance		-	2079	-	pF
$C_{rss}$	reverse transfer capacitance		-	293	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 15\text{ V}$ ; $R_L = 0.6\text{ }\Omega$ ; $V_{GS} = 4.5\text{ V}$ ; $R_{G(ext)} = 5\text{ }\Omega$	-	25.3	-	ns
$t_r$	rise time		-	31	-	ns
$t_{d(off)}$	turn-off delay time		-	38.7	-	ns
$t_f$	fall time		-	25.5	-	ns
$Q_{oss}$	output charge	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 15\text{ V}$ ; $f = 1\text{ MHz}$ ; $T_j = 25\text{ °C}$	-	47.4	-	nC
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 25\text{ A}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ °C}$ ; Fig. 15	-	0.78	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 25\text{ A}$ ; $di_S/dt = -100\text{ A}/\mu\text{s}$ ; $V_{GS} = 0\text{ V}$ ; $V_{DS} = 15\text{ V}$ ; Fig. 16	-	43.2	-	ns
$Q_r$	recovered charge		[1]	43	-	nC
$t_a$	reverse recovery rise time		-	22.2	-	ns
$t_b$	reverse recovery fall time		-	21	-	ns
S	softness factor		-	0.95	-	

[1] includes capacitive recovery



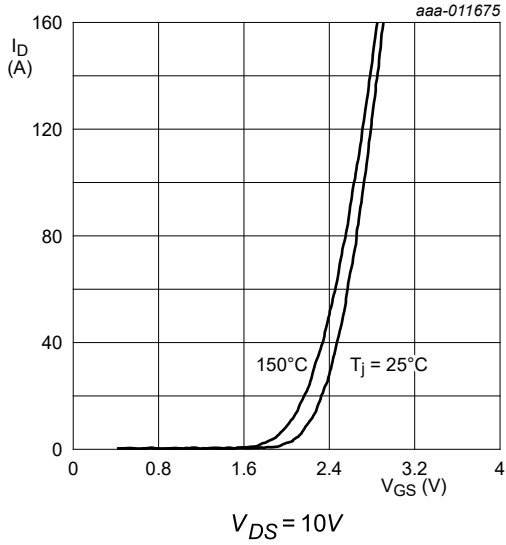


Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

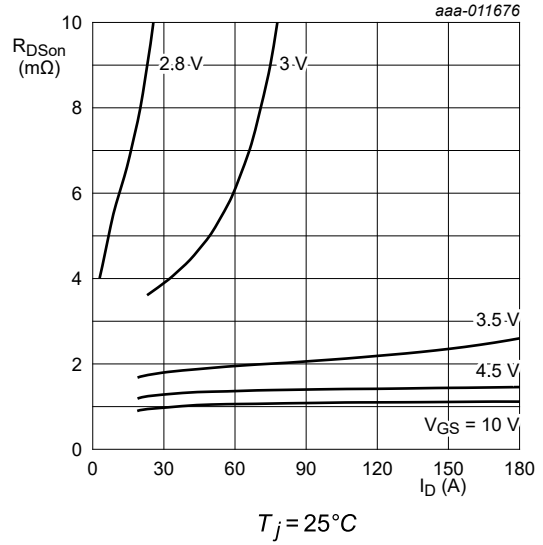


Fig. 10. Drain-source on-state resistance as a function of drain current; typical values

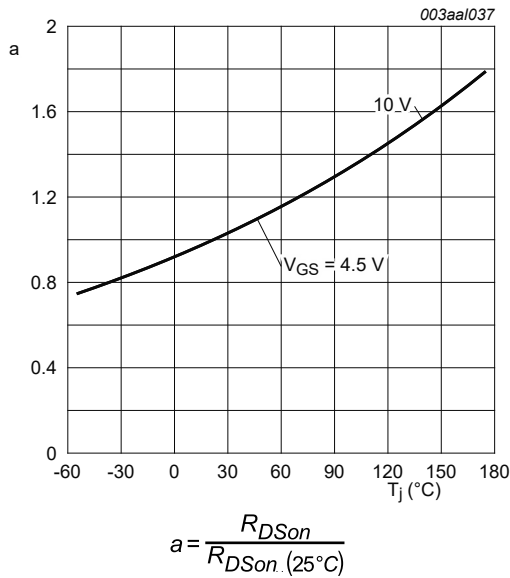


Fig. 11. Normalized drain-source on-state resistance factor as a function of junction temperature

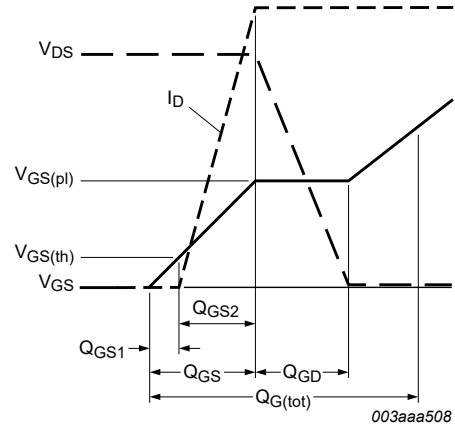


Fig. 12. Gate charge waveform definitions

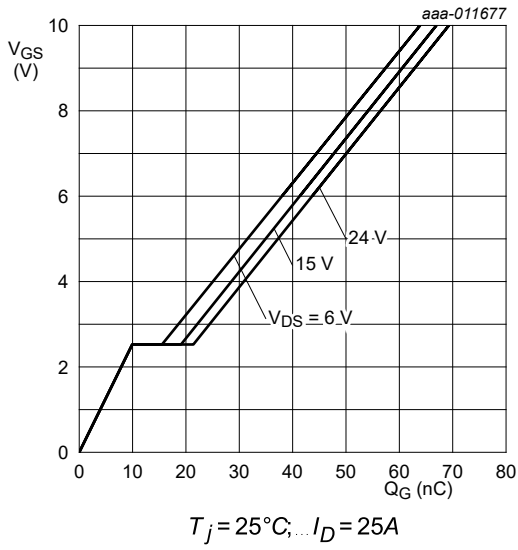


Fig. 13. Gate-source voltage as a function of gate charge; typical values

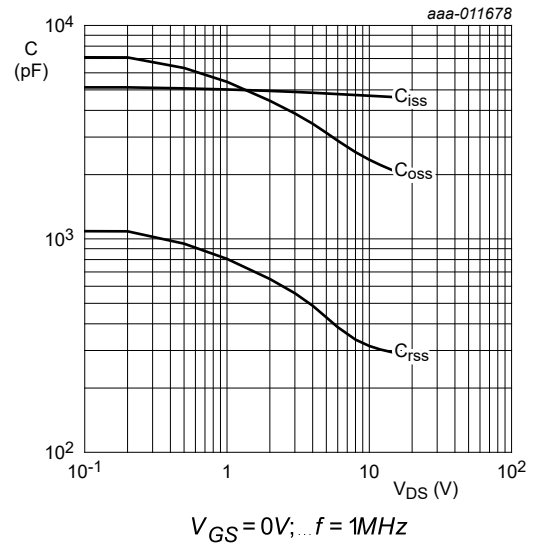


Fig. 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

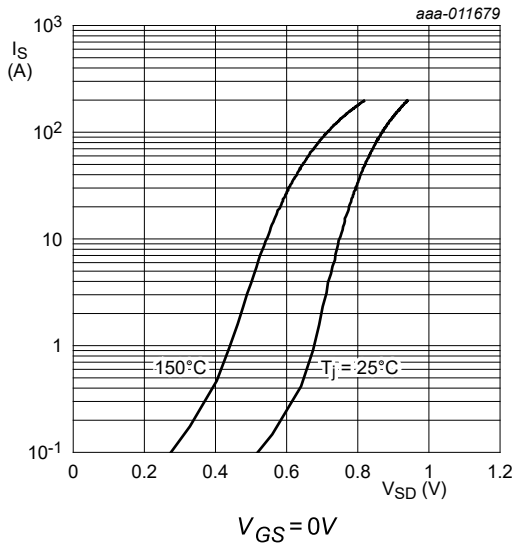


Fig. 15. Source current as a function of source-drain voltage; typical values

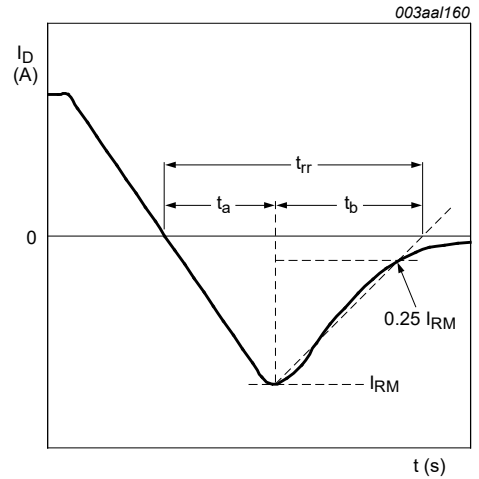


Fig. 16. Reverse recovery timing definition



11. Package outline

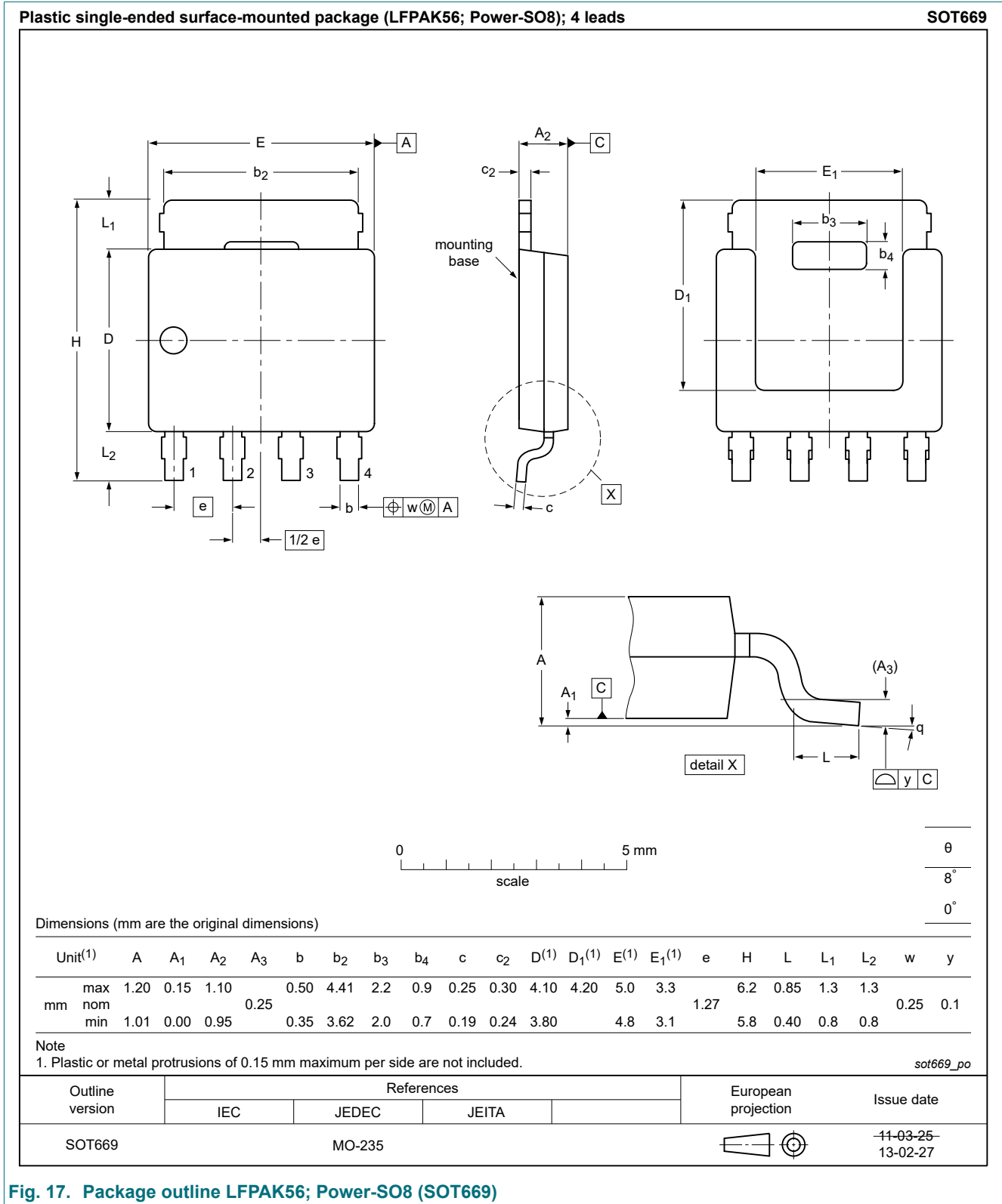


Fig. 17. Package outline LPAK56; Power-SO8 (SOT669)

## 12. Soldering

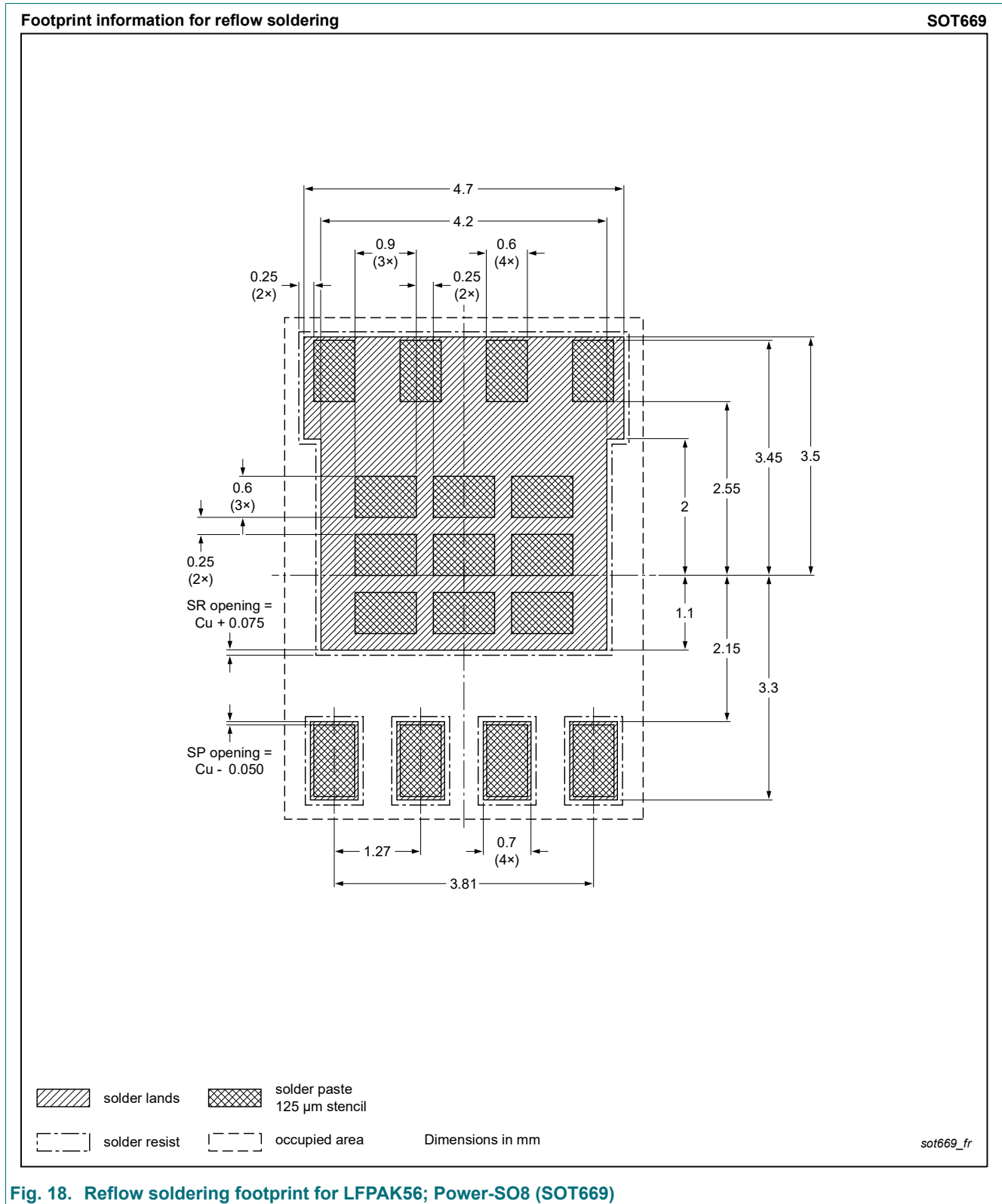


Fig. 18. Reflow soldering footprint for LFPAK56; Power-SO8 (SOT669)

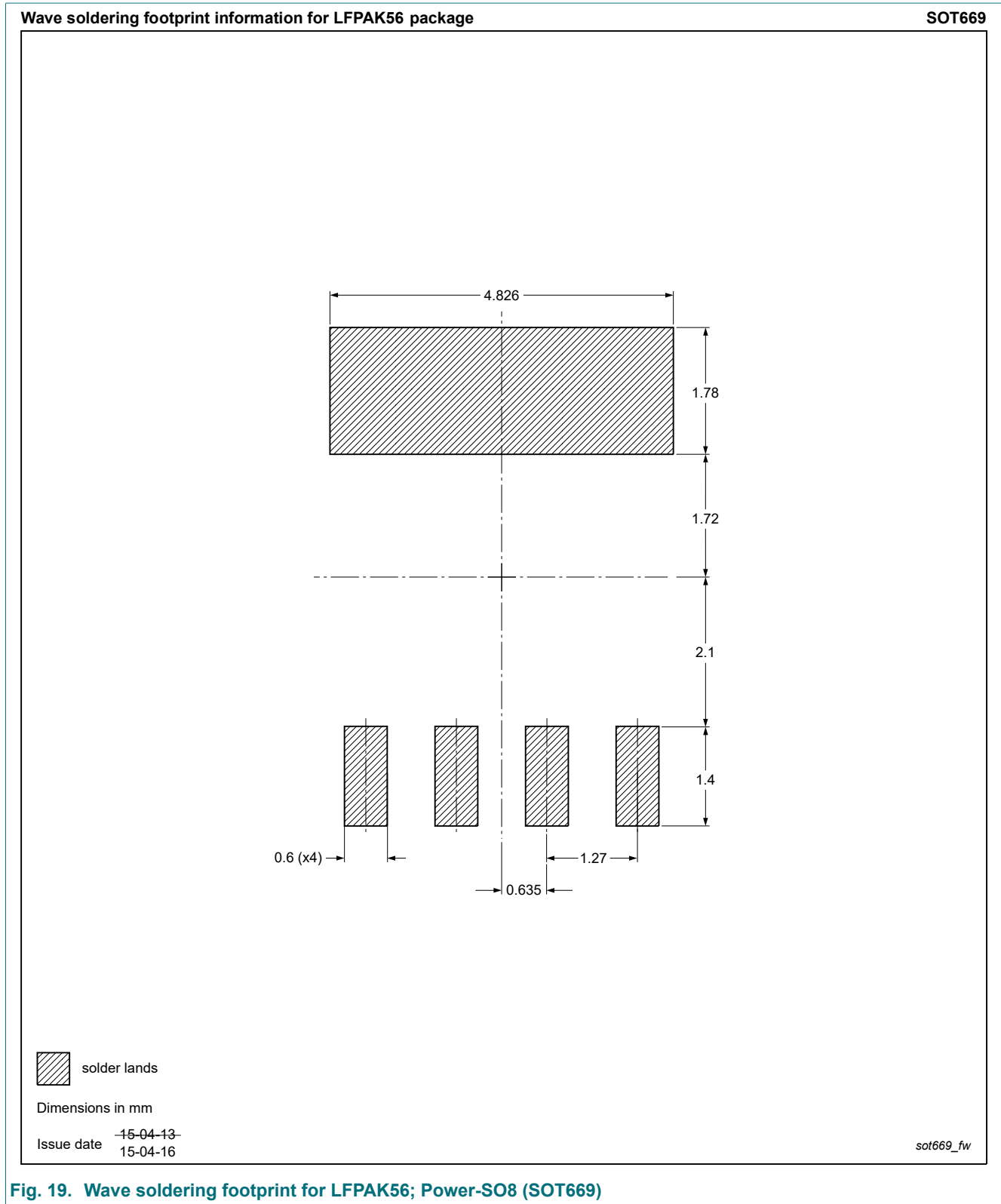


Fig. 19. Wave soldering footprint for LFPAK56; Power-SO8 (SOT669)

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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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## Contents

---

1. General description.....	1
2. Features and benefits.....	1
3. Applications.....	1
4. Quick reference data.....	1
5. Pinning information.....	2
6. Ordering information.....	2
7. Marking.....	2
8. Limiting values.....	2
9. Thermal characteristics.....	4
10. Characteristics.....	5
11. Package outline.....	9
12. Soldering.....	10
13. Legal information.....	12

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