PSMN2R0-40YLB

N-channel 40 V, 2.1 mOhm, 180 A logic level MOSFET in LFPAK56 using optimized NextPowerS3 Schottky-Plus technology

15 November 2023 **Product data sheet**

1. General description

180 A, logic level gate drive N-channel enhancement mode MOSFET in 175 °C LFPAK56 package, using advanced TrenchMOS Superjunction technology with optimization to provide improved EMC performance (up to 6 dB). This product has been designed and qualified for high performance power switching applications.

2. Features and benefits

- Optimized for improved EMC Performance
- 180 A continuous $I_{D(max)}$ rating
- Avalanche rated, 100% tested at I_{AS} = 160 A
- Strong SOA (linear-mode) rating
- NextPowerS3 technology delivers 'superfast switching with soft body-diode recovery'
- Low Q_{rr}, Q_G and Q_{GD} for high system efficiency and low EMI designs
- Schottky-Plus body-diode with low V_{SD}, low Q_{rr}, soft recovery and low I_{DSS} leakage
- Optimized for 4.5 V gate drive utilizing NextPowerS3 Superjunction technology
- High reliability LFPAK (Power SO8) package, with copper-clip and solder die attach, qualified to 175 °C
- Exposed leads can be wave soldered, visual solder joint inspection and high quality solder joints providing excellent board level reliability
- Low parasitic inductance and resistance

3. Applications

- Automation, control and instrumentation
- Autonomous systems, Robotics and Cobots
- DC-to-DC converters
- Brushless DC motor control
- Brushed motors
- Battery isolation
- Industrial load-switch and eFuse
- Inrush management, hotswap

4. Quick reference data

Table 1. Quick reference data

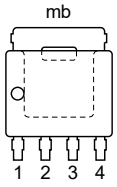
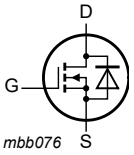
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	25 °C ≤ T_j ≤ 175 °C		-	-	40	V
I_D	drain current	V_{GS} = 10 V; T_{mb} = 25 °C; Fig. 2	[1]	-	-	180	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 1		-	-	166	W
T_j	junction temperature			-55	-	175	°C

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; #unique_6/unique_6_Connect_42_idaaa-037607		-	1.8	2.1	mΩ
		V_{GS} = 4.5 V; I_D = 25 A; T_j = 25 °C; #unique_6/unique_6_Connect_42_idaaa-037607		-	2.3	2.7	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	I_D = 25 A; V_{DS} = 20 V; V_{GS} = 4.5 V; T_j = 25 °C; #unique_6/unique_6_Connect_42_idaaa-037608; #unique_6/unique_6_Connect_42_id003aaa508		1.8	6	12	nC
$Q_{G(tot)}$	total gate charge			18	28	39	nC

[1] 180 A Continuous current has been successfully demonstrated during application tests. 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	 **LFPAK56; Power-SO8 (SOT669)**	
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		
	Name	Description	Version
PSMN2R0-40YLB	LFPAK56; Power-SO8	plastic, single-ended surface-mounted package; 4 terminals	SOT669

7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN2R0-40YLB	2B0L40Y

8. Limiting values

Table 5. Limiting values

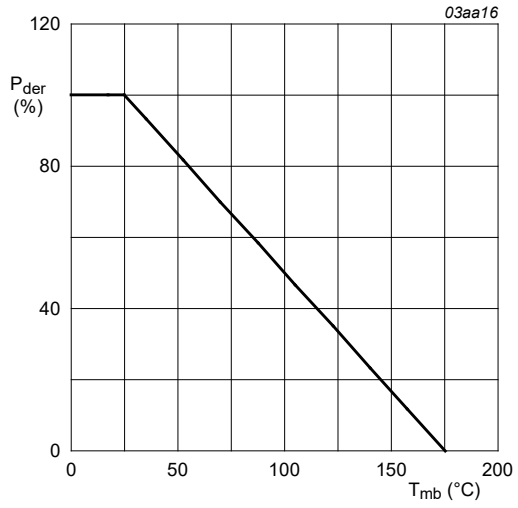
In accordance with the Absolute Maximum Rating System (IEC 60134). Tj = 25 °C unless otherwise stated.

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	25 °C ≤ T_j ≤ 175 °C		-	40	V

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DSM}	peak drain-source voltage	$t_p \leq$ 20 ns; f = 500 kHz; $E_{DS(AL)} \leq$ 200 nJ; pulsed		-	45	V
V_{DGR}	drain-gate voltage	25 °C ≤ $T_j \leq$ 175 °C; R_{GS} = 20 kΩ		-	40	V
V_{GS}	gate-source voltage			-20	20	V
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 1		-	166	W
I_D	drain current	V_{GS} = 10 V; T_{mb} = 25 °C; Fig. 2	[1]	-	180	A
		V_{GS} = 10 V; T_{mb} = 100 °C; Fig. 2		-	143	A
I_{DM}	peak drain current	pulsed; $t_p \leq$ 10 µs; T_{mb} = 25 °C; Fig. 3		-	807	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		-	166	A
I_{SM}	peak source current	pulsed; $t_p \leq$ 10 µs; T_{mb} = 25 °C		-	807	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 53.5 A; $V_{sup} \leq$ 40 V; R_{GS} = 50 Ω; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; unclamped; t_p = 182 µs	[2]	-	253	mJ
		I_D = 25 A; $V_{sup} \leq$ 40 V; R_{GS} = 50 Ω; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; unclamped; t_p = 937 µs	[2]	-	609	mJ
I_{AS}	non-repetitive avalanche current	$V_{sup} \leq$ 40 V; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; R_{GS} = 50 Ω	[2]	-	160	A

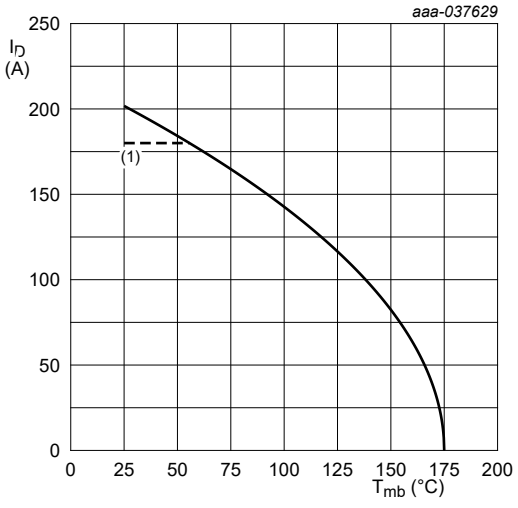
[1] 180 A Continuous current has been successfully demonstrated during application tests. Practically the current will be limited by PCB, thermal design and operating temperature.

[2] Protected by 100% test



$$P_{der} = \frac{P_{tot}}{P_{tot(25°C)}} \times 100\,\%$$

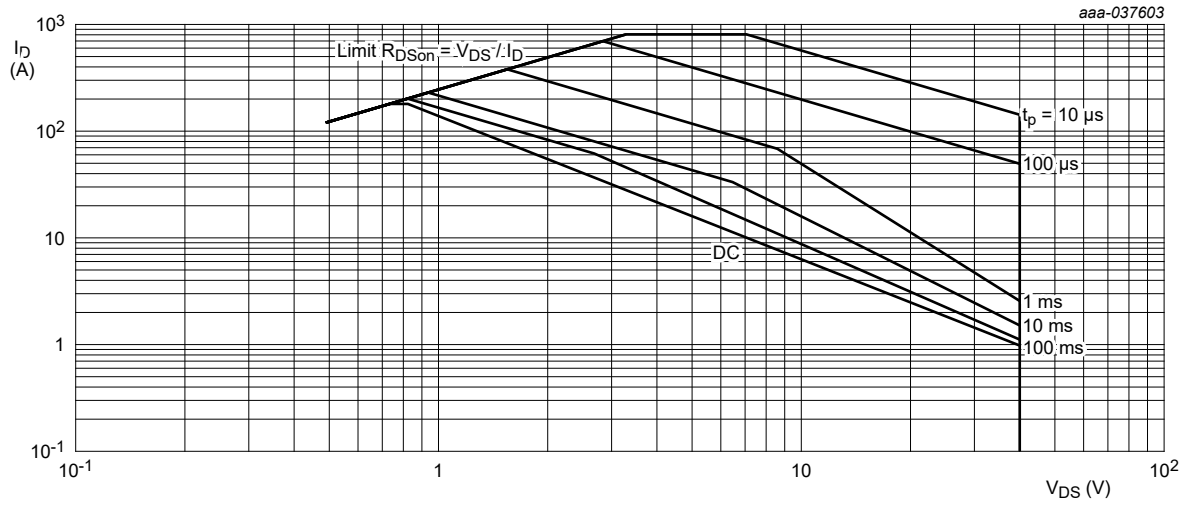
Fig. 1. Normalized total power dissipation as a function of mounting base temperature



$V_{GS} \geq$ 10 V

(1) 180 A continuous current has been successfully demonstrated during application tests. Practically the current will be limited by PCB, thermal design and operating temperature.

Fig. 2. Continuous drain current as a function of mounting base temperature



T_{mb} = 25 °C; I_{DM} is a single pulse

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		-	0.8	0.9	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	Fig. 5		-	42	-	K/W
		Fig. 6		-	85	-	K/W

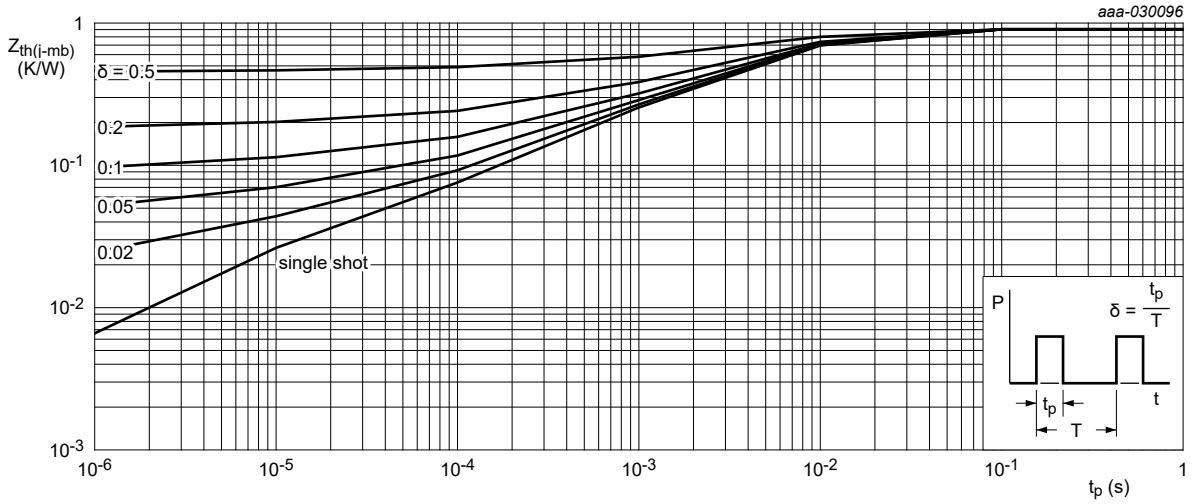
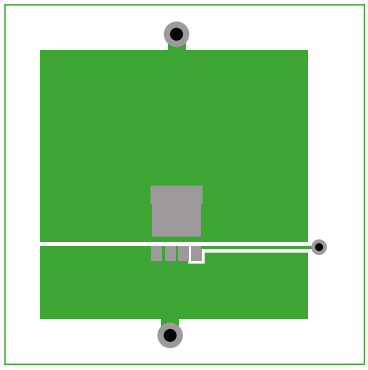
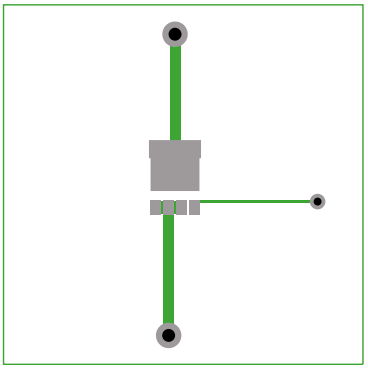


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration



Copper area 25.4 mm square; 70 µm thick on FR4 board

Fig. 5. PCB layout for thermal resistance from junction to ambient

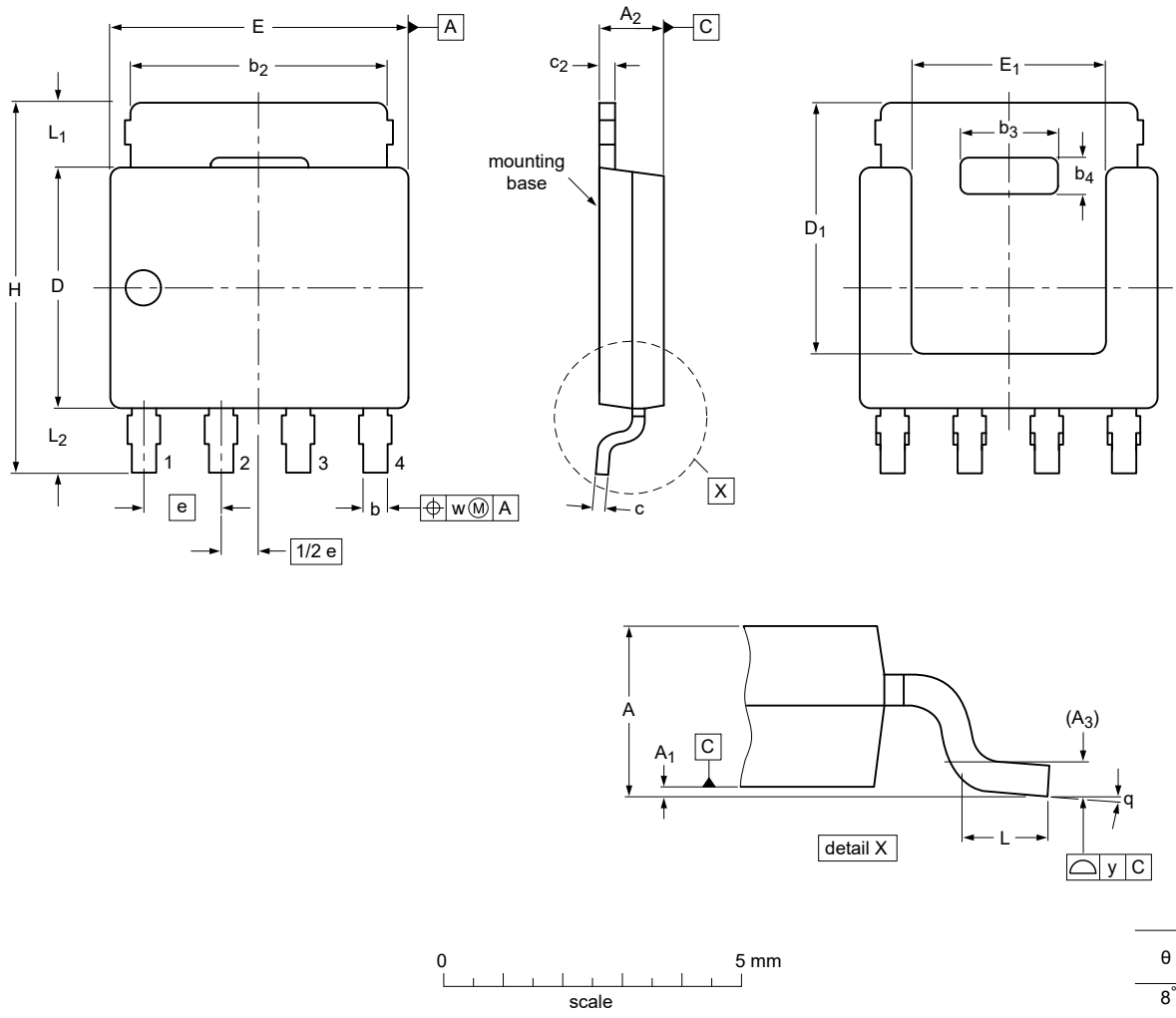


70 µm thick copper on FR4 board

Fig. 6. PCB layout with minimum footprint for thermal resistance from junction to ambient

10. Package outline

Plastic single-ended surface-mounted package (LFPAK56; Power-SO8); 4 leads **SOT669**



Dimensions (mm are the original dimensions)

Unit[1]		A	A_1	A_2	A_3	b	b_2	b_3	b_4	c	c_2	$D^{(1)}$	$D_1{}^{(1)}$	$E^{(1)}$	$E_1{}^{(1)}$	e	H	L	L_1	L_2	w	y
mm	max	1.20	0.15	1.10		0.50	4.41	2.2	0.9	0.25	0.30	4.10	4.20	5.0	3.3		6.2	0.85	1.3	1.3		
	nom				0.25											1.27					0.25	0.1
	min	1.01	0.00	0.95		0.35	3.62	2.0	0.7	0.19	0.24	3.80		4.8	3.1		5.8	0.40	0.8	0.8		

θ
8°
0°

Note
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

sot669_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT669		MO-235				~~11-03-25~~ 13-02-27

Fig. 7. Package outline LFPAK56; Power-SO8 (SOT669)

11. Soldering

Footprint information for reflow soldering **SOT669**

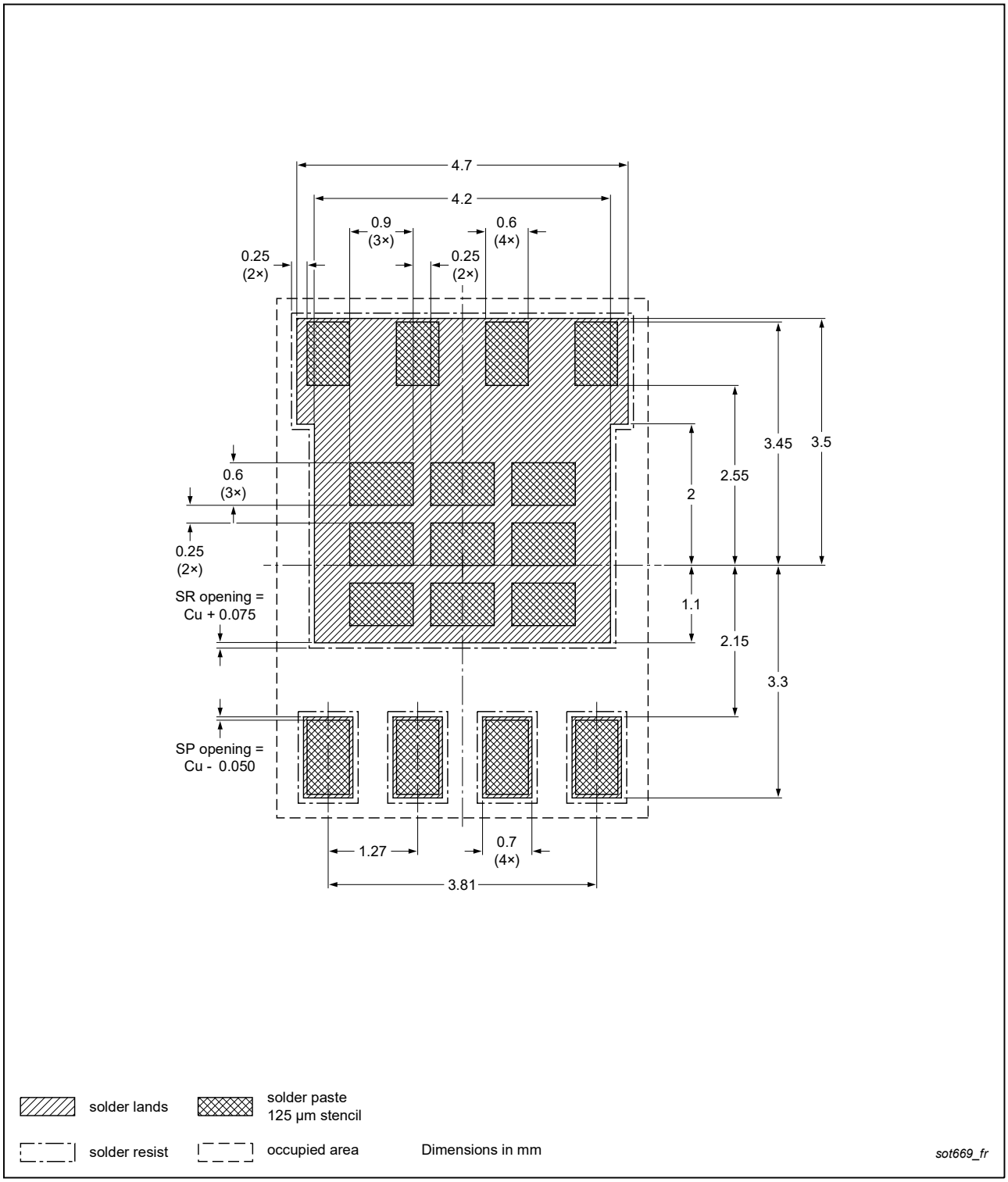


Fig. 8. Reflow soldering footprint for LFPAK56; Power-SO8 (SOT669)

Wave soldering footprint information for LFPAK56 package **SOT669**

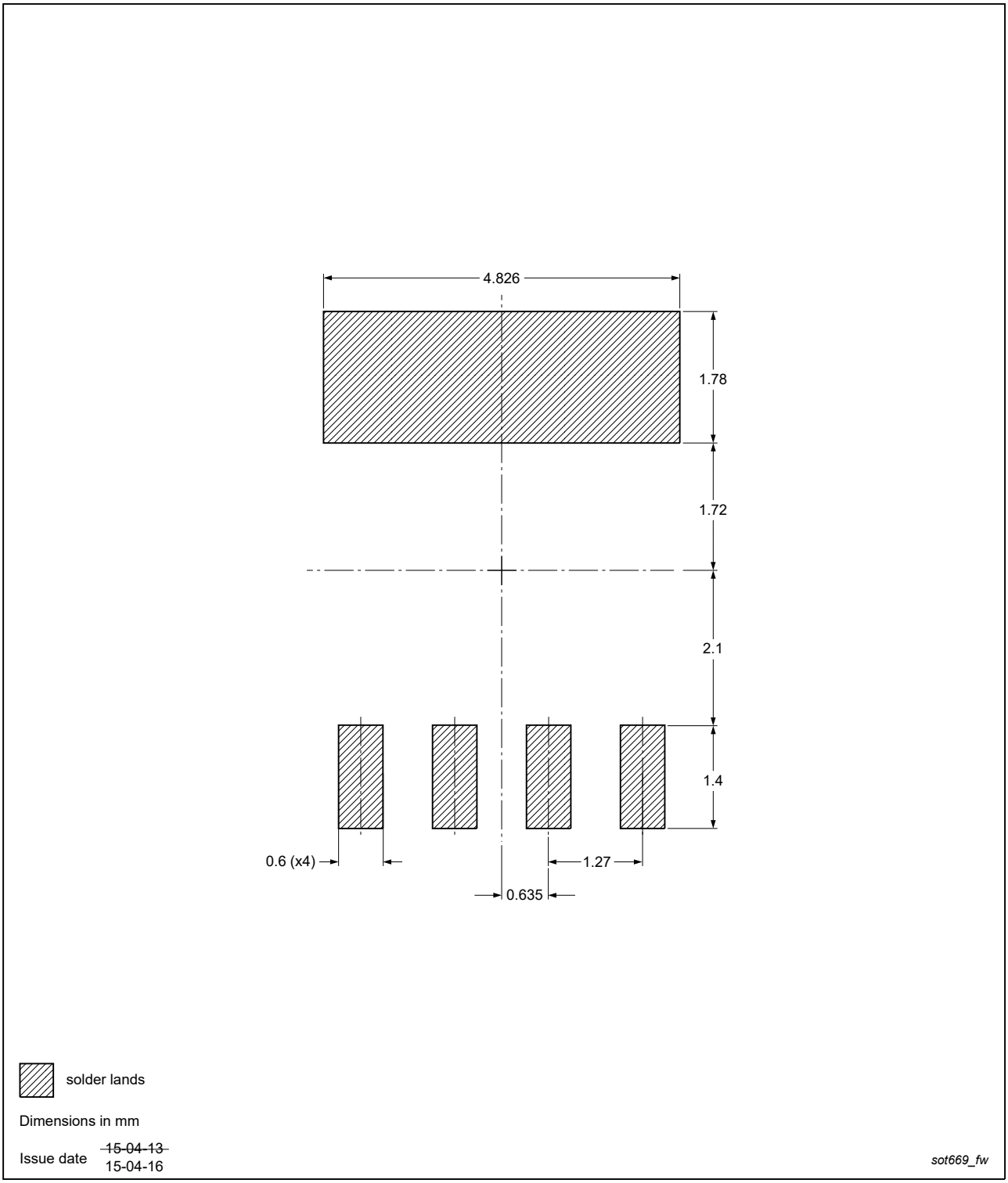


Fig. 9. Wave soldering footprint for LFPAK56; Power-SO8 (SOT669)

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.
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