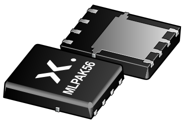


PXN2R9-100RS

N-channel 100 V, 2.9 mOhm, standard level Trench MOSFET in MLPAK56

16 August 2024 Product data sheet

1. General description

General purpose MOSFET for standard applications, 180 A, standard level N-channel enhancement mode Power MOSFET in MLPAK56 package.

2. Features and benefits

- Standard level compatibility
- Trench MOSFET technology
- Thermally efficient package in a small form factor (5.15 mm x 6.15 mm footprint)

3. Applications

- Secondary side synchronous rectification
- DC-to-DC converters
- Home appliance
- Motor drive
- Load switching
- LED lighting
- E-bike

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 ≤ 150 °C		-	-	100	V
I_D	drain current	V_{GS} = 10 V; T_{mb} = 25 °C; Fig. 2		-	-	180	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 1		-	-	181	W
T_j	junction temperature			-55	-	150	°C
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; Fig. 9		-	2.65	2.9	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	I_D = 25 A; V_{DS} = 50 V; V_{GS} = 10 V; T_j = 25 °C; Fig. 11; Fig. 12		-	19	-	nC
$Q_{G(tot)}$	total gate charge			-	74	-	nC
Avalanche ruggedness							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 52.5 A; V_{sup} ≤ 100 V; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; unclamped	[1]	-	-	275.6	mJ

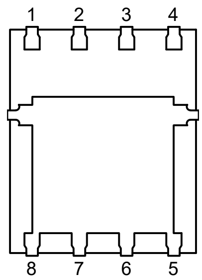
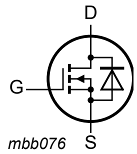
nexperia

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Source-drain diode							
Q_r	recovered charge	I_S = 25 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 50 V; T_j = 25 °C; Fig. 15	[2]	-	48	-	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	S	source	 MLPAK56 (SOT8038-1)	
2	S	source		
3	S	source		
4	G	gate		
5	D	drain		
6	D	drain		
7	D	drain		
8	D	drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PXN2R9-100RS	MLPAK56	plastic thermal enhanced surface mounted package; mini leads; 8 terminals; pitch 1.27 mm; 6 x 5 x 1.0 mm body	SOT8038-1

7. Marking

Table 4. Marking codes

Type number	Marking code
PXN2R9-100RS	2R9-100

8. Limiting values

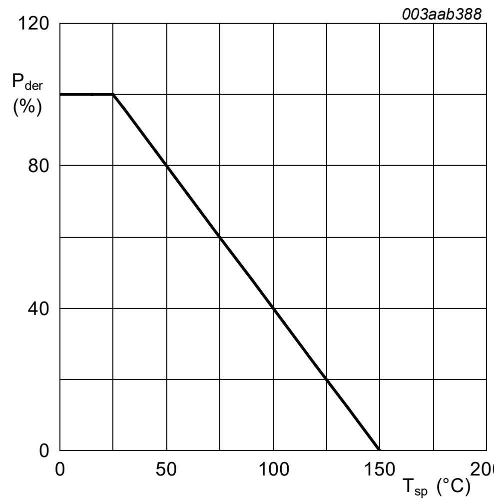
Table 5. Limiting values

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 ≤ 150 °C		-	100	V
V_{GS}	gate-source voltage			-20	20	V
P_{tot}	total power dissipation	T_{mb} = 25 °C; Fig. 1		-	181	W
I_D	drain current	V_{GS} = 10 V; T_{mb} = 25 °C; Fig. 2		-	180	A
		V_{GS} = 10 V; T_{mb} = 100 °C; Fig. 2		-	114	A
I_{DM}	peak drain current	pulsed; t_p ≤ 10 µs; T_{mb} = 25 °C; Fig. 3		-	722	A
T_{stg}	storage temperature			-55	150	°C

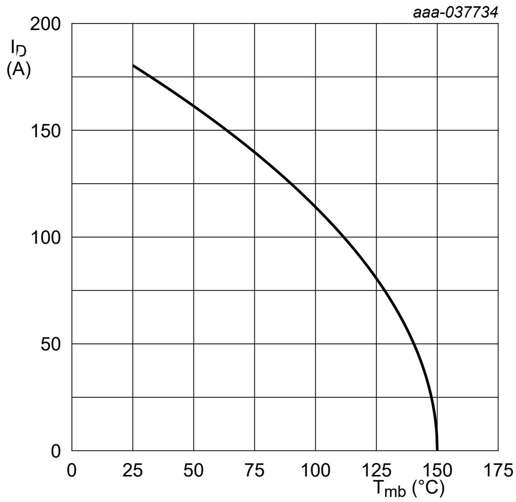
Symbol	Parameter	Conditions		Min	Max	Unit
T_j	junction temperature			-55	150	°C
$T_{sld(M)}$	peak soldering temperature			-	260	°C
Source-drain diode						
I_S	source current	T_{mb} = 25 °C		-	151	A
I_{SM}	peak source current	pulsed; $t_p \leq$ 10 µs; T_{mb} = 25 °C		-	722	A
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	I_D = 52.5 A; $V_{sup} \leq$ 100 V; V_{GS} = 10 V; $T_{j(init)}$ = 25 °C; unclamped	[1]	-	275.6	mJ
I_{AS}	non-repetitive avalanche current	$T_{j(init)}$ = 25 °C	[1]	-	52.5	A

[1] Protected by 100% test



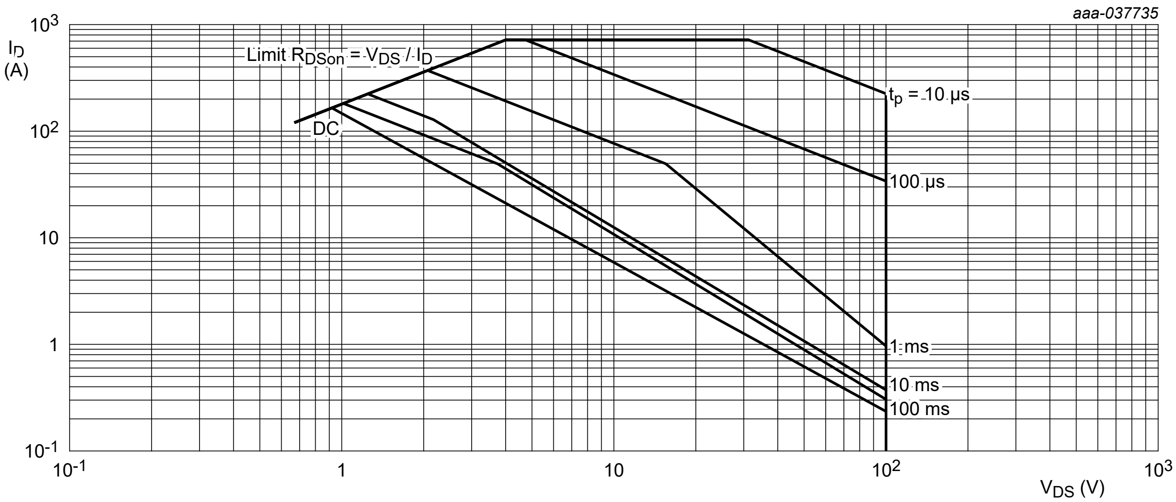
$$P_{der} = \frac{P_{tot}}{P_{tot(25\,°C)}} \times 100\,\%$$

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



$V_{GS} \geq$ 10 V

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		-	0.57	0.69	K/W

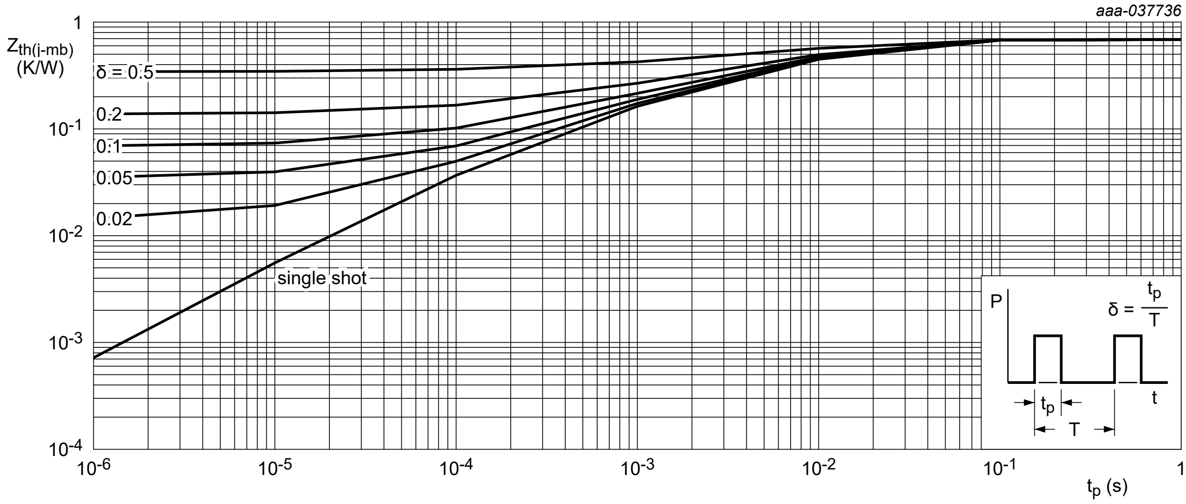


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

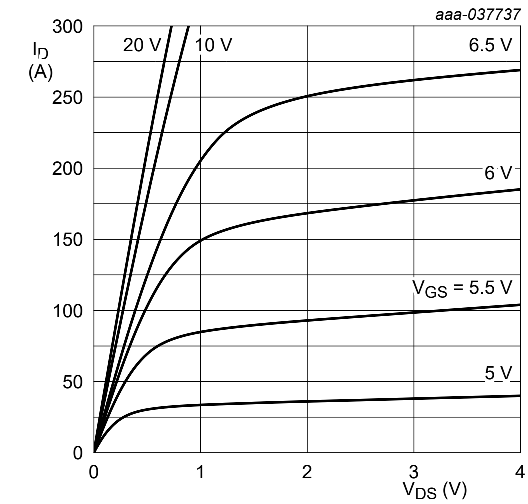
10. Characteristics

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		100	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = -55 °C		-	100	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 0.25 mA; V_{DS}=V_{GS}; T_j = 25 °C; Fig. 8		2.5	3	4	V
		I_D = 0.25 mA; V_{DS}=V_{GS}; T_j = 150 °C		-	1.6	-	V
		I_D = 0.25 mA; V_{DS}=V_{GS}; T_j = -55 °C		-	3.7	-	V
$\Delta V_{GS(th)}/\Delta T$	gate-source threshold voltage variation with temperature	25 °C ≤ T_j ≤ 150 °C		-	-11.2	-	mV/K
I_{DSS}	drain leakage current	V_{DS} = 100 V; V_{GS} = 0 V; T_j = 25 °C		-	0.07	1	µA
		V_{DS} = 100 V; V_{GS} = 0 V; T_j = 150 °C		-	74	-	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
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 25 A; T_j = 25 °C; Fig. 9		-	2.65	2.9	mΩ
		V_{GS} = 10 V; I_D = 25 A; T_j = 150 °C; Fig. 10		-	-	5.6	mΩ
R_G	gate resistance	f = 1 MHz; T_j = 25 °C		-	1.7	-	Ω

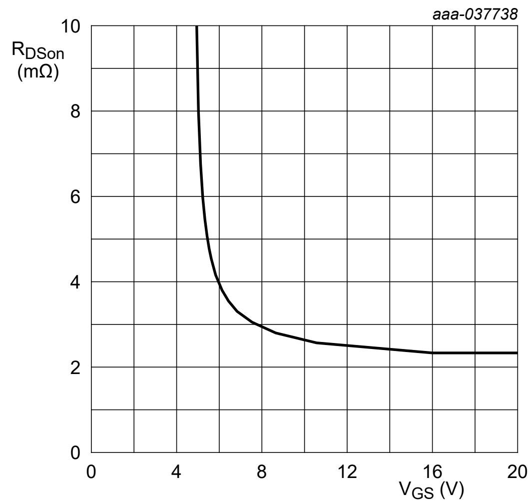
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 25 A; V_{DS} = 50 V; V_{GS} = 10 V; T_j = 25 °C; Fig. 11; Fig. 12		-	74	-	nC
		I_D = 0 A; V_{DS} = 0 V; V_{GS} = 10 V; T_j = 25 °C		-	62	-	nC
Q_{GS}	gate-source charge	I_D = 25 A; V_{DS} = 50 V; V_{GS} = 10 V; T_j = 25 °C; Fig. 11; Fig. 12		-	22	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge			-	13	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge			-	9	-	nC
Q_{GD}	gate-drain charge			-	19	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	I_D = 25 A; V_{DS} = 50 V; T_j = 25 °C; Fig. 11; Fig. 12		-	4.9	-	V
C_{iss}	input capacitance	V_{DS} = 50 V; V_{GS} = 0 V; f = 1 MHz; T_j = 25 °C; Fig. 13		-	4892	-	pF
C_{oss}	output capacitance			-	1948	-	pF
C_{rss}	reverse transfer capacitance			-	29	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 50 V; R_L = 2 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 5 Ω; T_j = 25 °C		-	21	-	ns
t_r	rise time			-	27	-	ns
$t_{d(off)}$	turn-off delay time			-	46	-	ns
t_f	fall time			-	33	-	ns
Q_{oss}	output charge	V_{GS} = 0 V; V_{DS} = 50 V; f = 1 MHz; T_j = 25 °C		-	145	-	nC
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 25 A; V_{GS} = 0 V; T_j = 25 °C; Fig. 14		-	0.8	1.2	V
t_{rr}	reverse recovery time	I_S = 25 A; dI_S/dt = -100 A/μs; V_{GS} = 0 V; V_{DS} = 50 V; T_j = 25 °C; Fig. 15		-	47	-	ns
Q_r	recovered charge		[1]	-	48	-	nC

[1] includes capacitive recovery



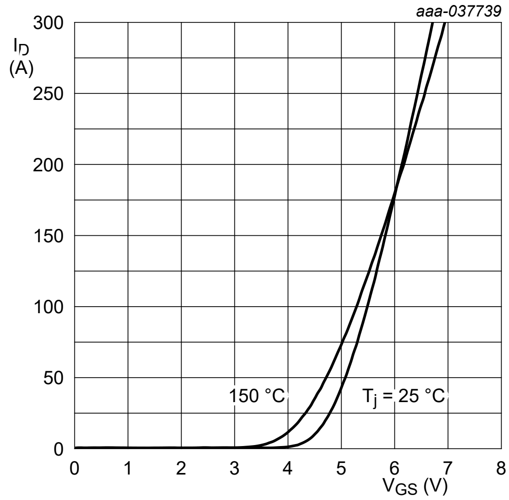
T_j = 25 °C

Fig. 5. Output characteristics; drain current as a function of drain-source voltage; typical values



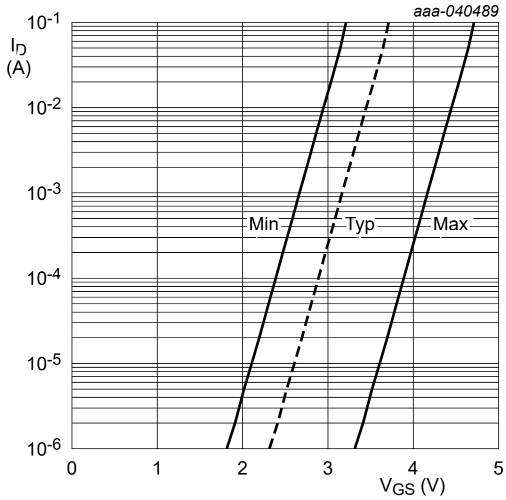
T_j = 25 °C; I_D = 25 A

Fig. 6. Drain-source on-state resistance as a function of gate-source voltage; typical values



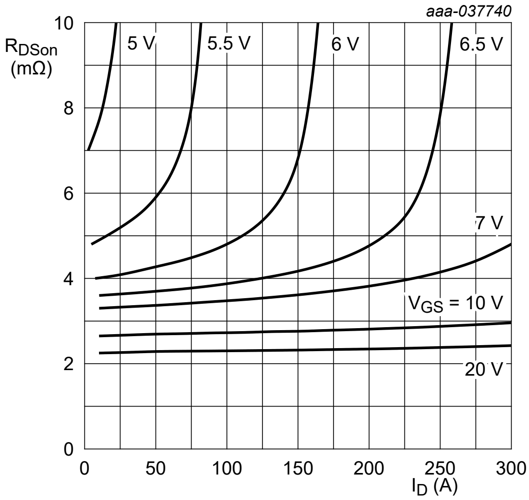
V_{DS} = 8 V

Fig. 7. Transfer characteristics; drain current as a function of gate-source voltage; typical values



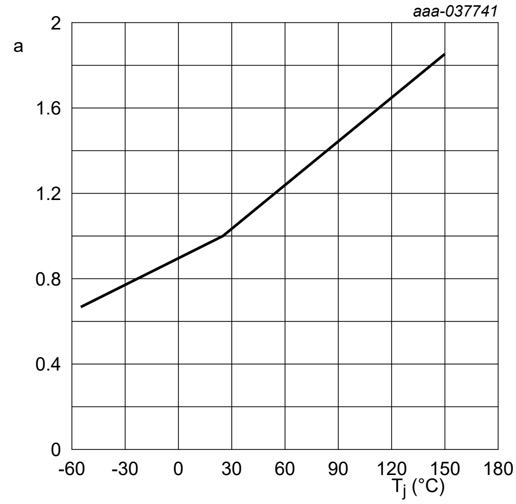
T_j = 25 °C; V_{DS} = 5 V

Fig. 8. Sub-threshold drain current as a function of gate-source voltage



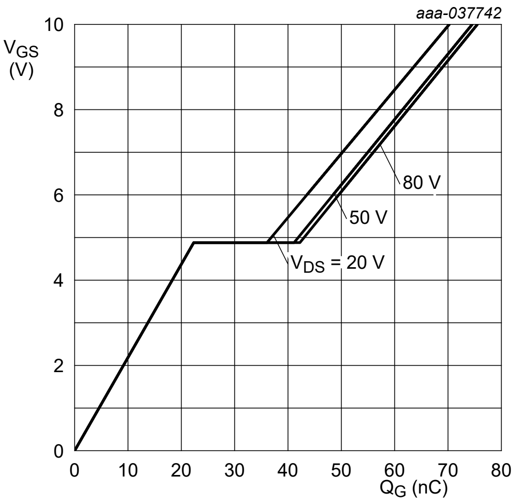
T_j = 25 °C

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



$$a = \frac{R_{DSon}}{R_{DSon}(25\ °C)}$$

Fig. 10. Normalized drain-source on-state resistance factor as a function of junction temperature



T_j = 25 °C; I_D = 25 A

Fig. 11. Gate-source voltage as a function of gate charge; typical values

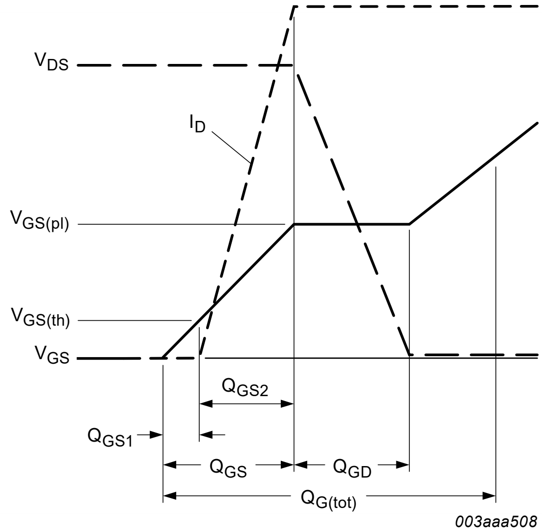
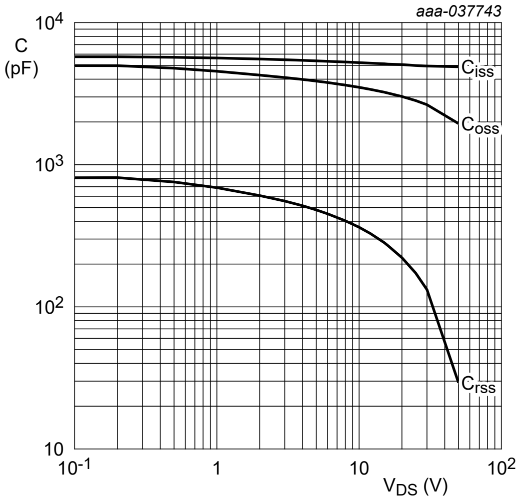
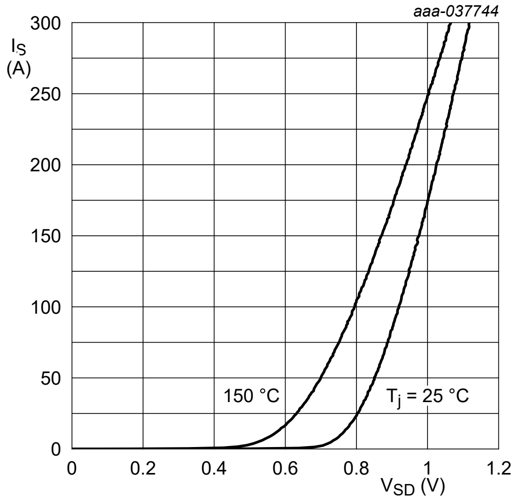


Fig. 12. Gate charge waveform definitions



V_{GS} = 0 V; f = 1 MHz

Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



V_{GS} = 0 V

Fig. 14. Source-drain (diode forward) current as a function of source-drain (diode forward) voltage; typical values

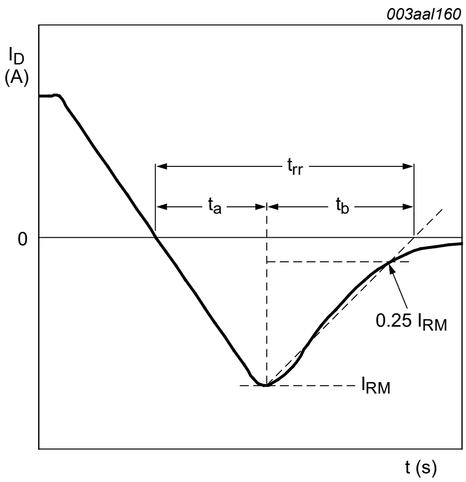
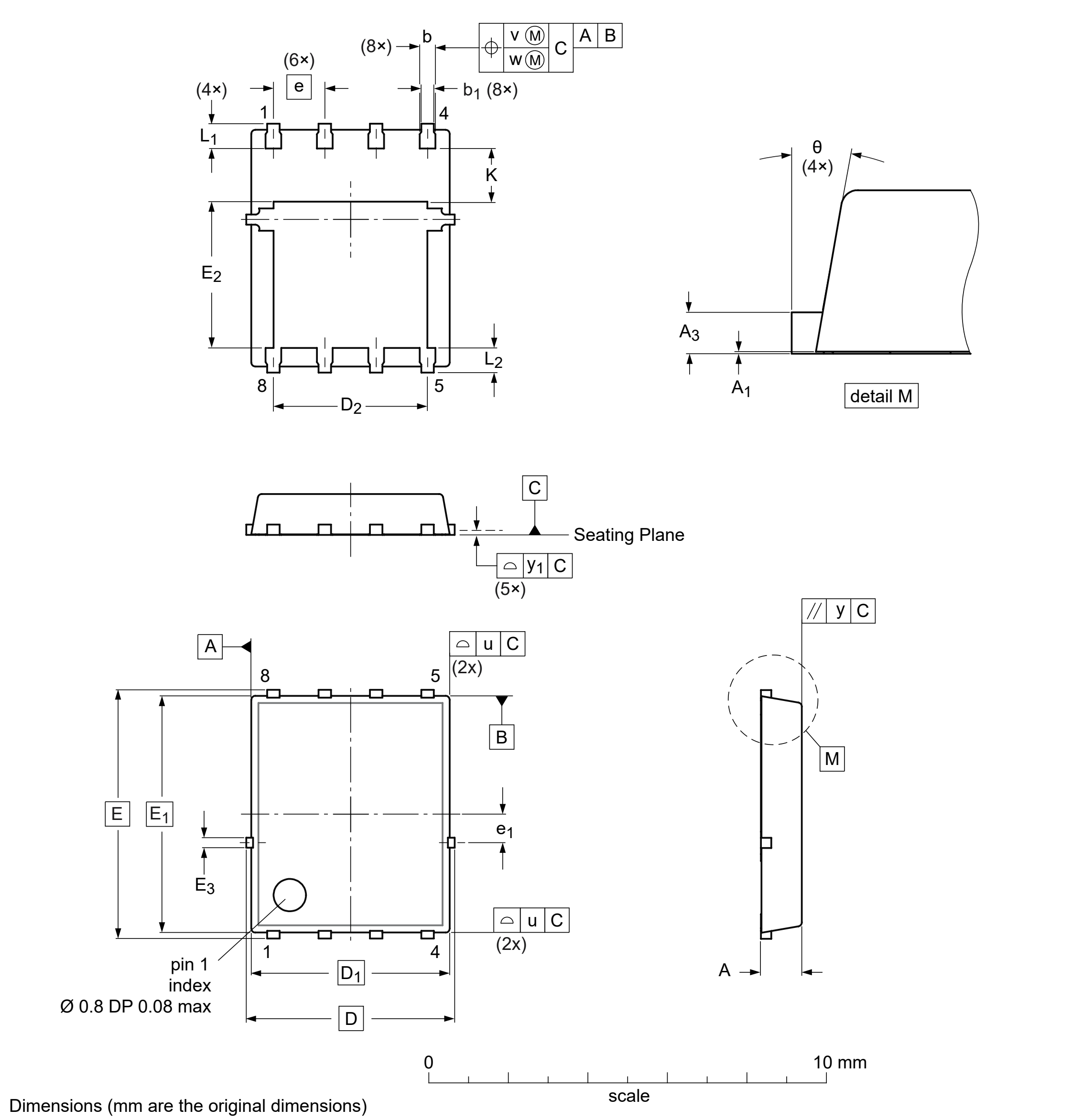


Fig. 15. Reverse recovery timing definition

11. Package outline

MLPAK56: plastic thermal enhanced surface mounted package; mini leads; 8 terminals; pitch 1.27 mm; 6 x 5 x 1.0 mm body **SOT8038-1**



Dimensions (mm are the original dimensions)

Unit[1]		A	A_1	A_3	b	b_1	D	D_1	D_2	E	E_1	E_2	E_3	e	e_1	K	L_1	L_2	y	y_1	u	v	w	θ
mm	max	1.05	0.05	0.254 REF	0.51	0.41	5.30	5 BSC	3.9	6.30	6 BSC	3.76	0.33	1.27 BSC	0.7 REF	1.3 REF	0.71	0.71	0.1	0.08	0.1	0.1	0.05	12°
	nom	1.0			0.41	0.31	5.15		3.8	6.15		3.66	0.28				0.61	0.61						11°
	min	0.95	0		0.31	0.21	5.00		3.7	6.00		3.56	0.23				0.51	0.51						10°

Note
1. Dimension b applies to metallized terminal and is measured between 0.25 mm and 0.30 mm from terminal tip.

sot8038-1_po

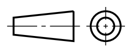
Outline version	References IEC	References JEDEC	References JEITA		European projection	Issue date
SOT8038-1						24-06-28

Fig. 16. Package outline MLPAK56 (SOT8038-1)

12. Soldering

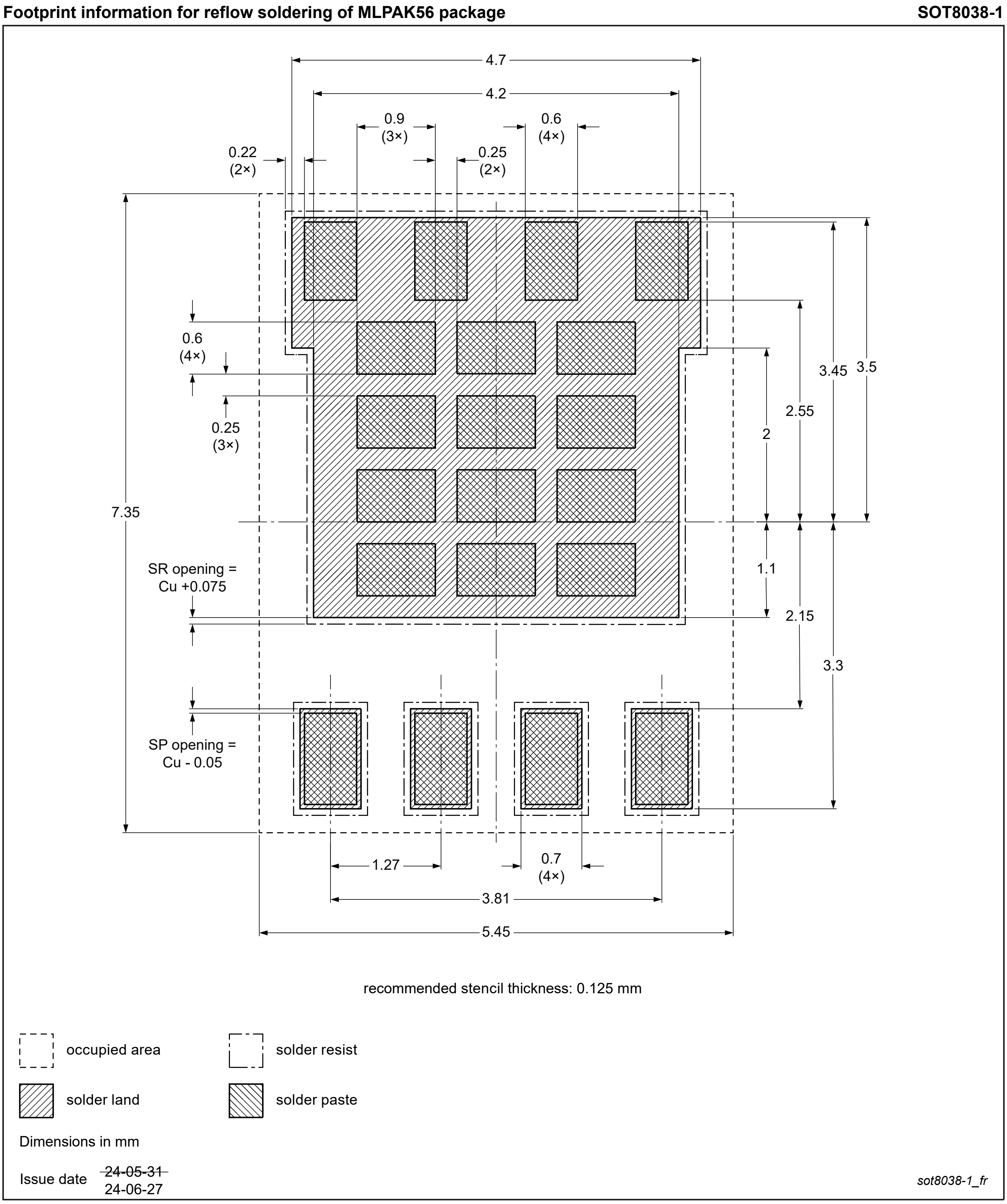


Fig. 17. Reflow soldering footprint for MLPAK56 (SOT8038-1)

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.
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[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 16 August 2024