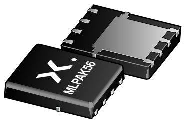



# PXN2R9-100RS

## 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**

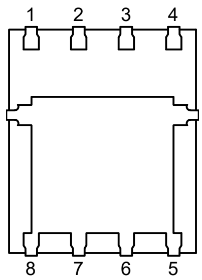
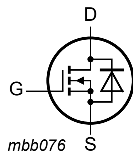
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | 25 °C ≤ $T_j$ ≤ 150 °C | | - | - | 100 | V |
| $I_D$ | drain current | $V_{GS}$ = 10 V; $T_{mb}$ = 25 °C; Fig. 2 | | - | - | 180 | A |
| $P_{tot}$ | total power dissipation | $T_{mb}$ = 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 |

| 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

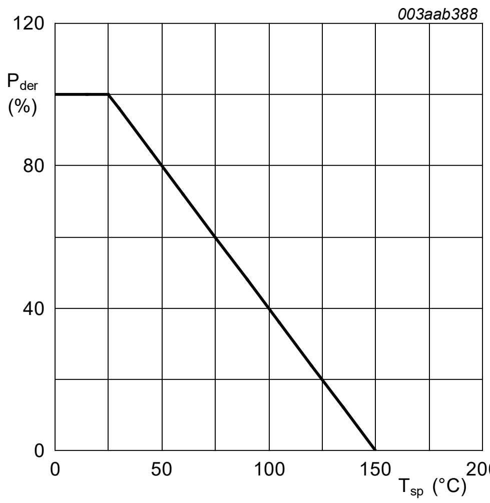
**Table 5. Limiting values**

*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 |

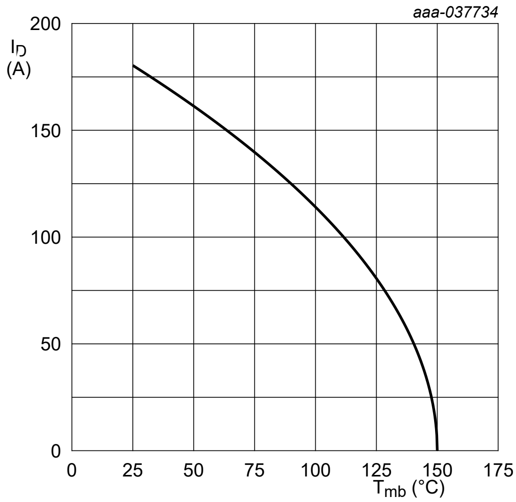
| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $T_j$ | junction temperature | | | -55 | 150 | °C |
| $T_{sld(M)}$ | peak soldering temperature | | | - | 260 | °C |
| **Source-drain diode** | | | | | | |
| $I_S$ | source current | $T_{mb}$ = 25 °C | | - | 151 | A |
| $I_{SM}$ | peak source current | pulsed; $t_p$ ≤ 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; $V_{sup}$ ≤ 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



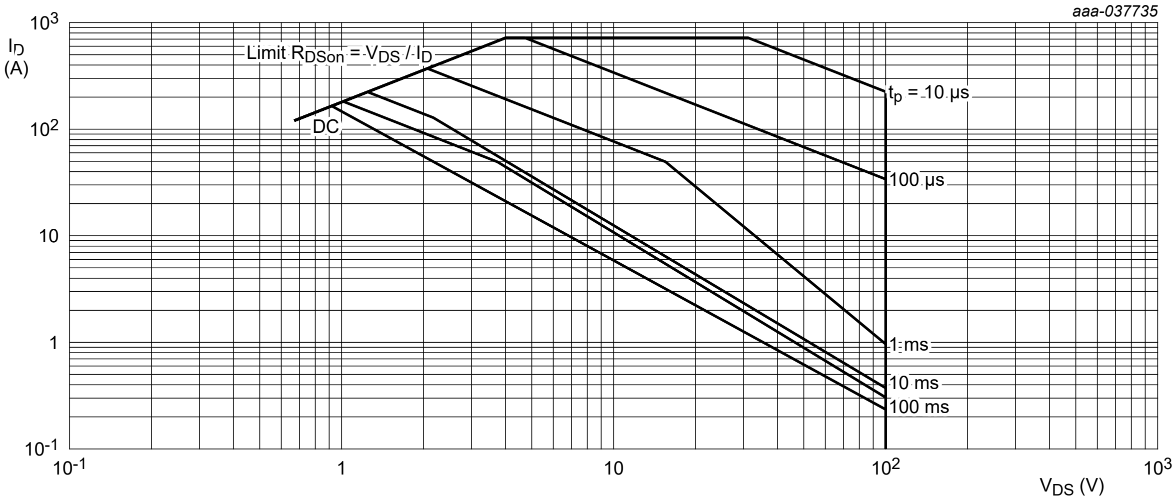

$$P_{der} = \frac{P_{tot}}{P_{tot(25\,°C)}} \times 100\,\%$$

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




$V_{GS}$ ≥ 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 |

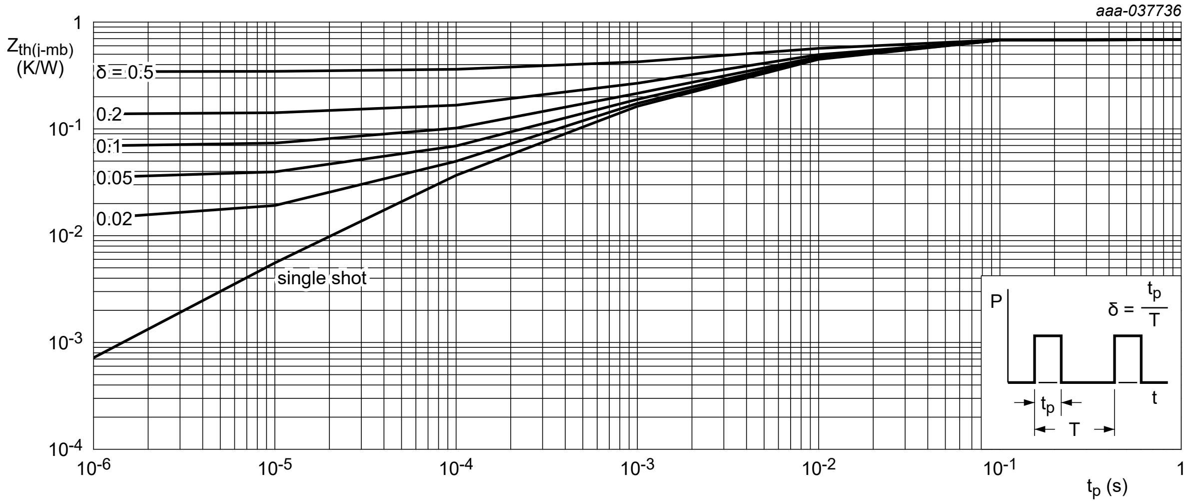



**Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration**

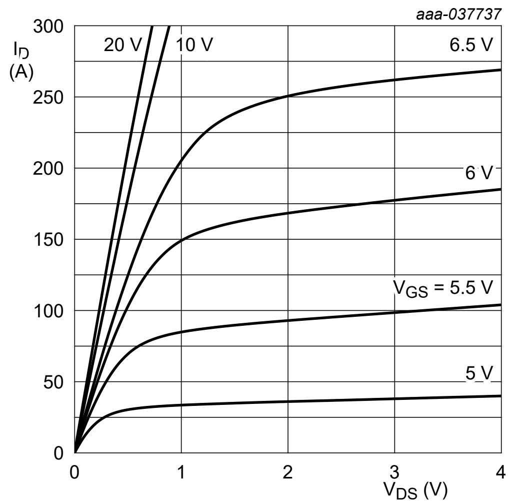
# 10. Characteristics

**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 |

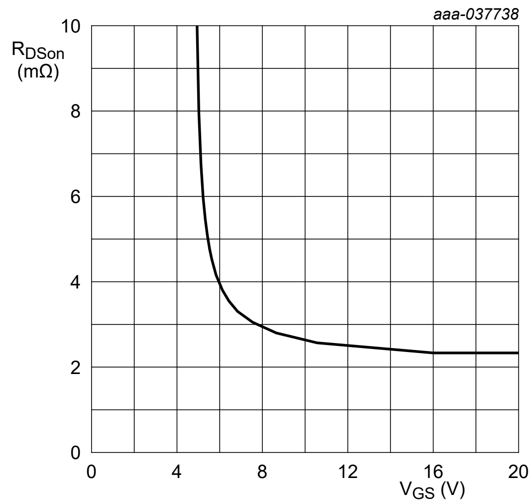
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Dynamic characteristics** | | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D$ = 25 A; $V_{DS}$ = 50 V; $V_{GS}$ = 10 V; $T_j$ = 25 °C; Fig. 11; Fig. 12 | | - | 74 | - | nC |
| | | $I_D$ = 0 A; $V_{DS}$ = 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



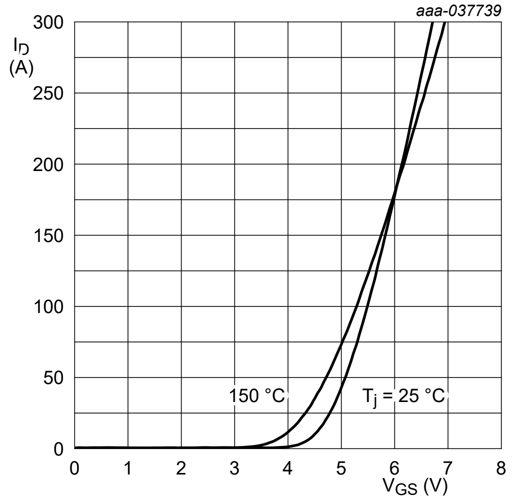

$T_j$ = 25 °C

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



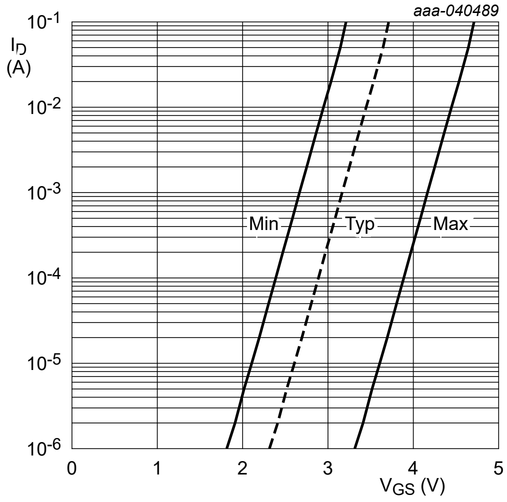

$T_j$ = 25 °C; $I_D$ = 25 A

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



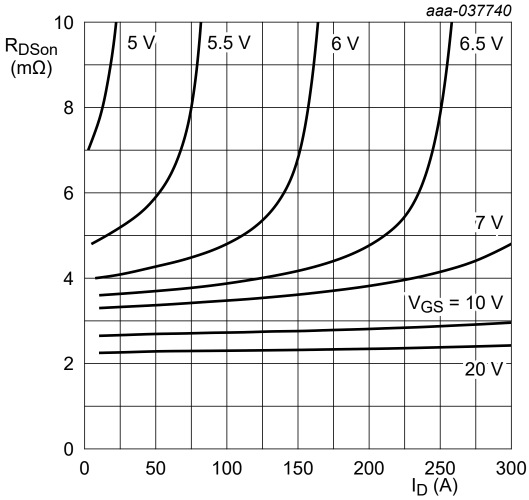

$V_{DS}$ = 8 V

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



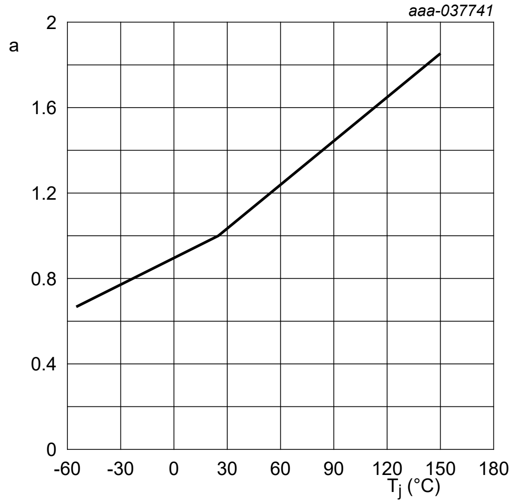

$T_j$ = 25 °C; $V_{DS}$ = 5 V

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



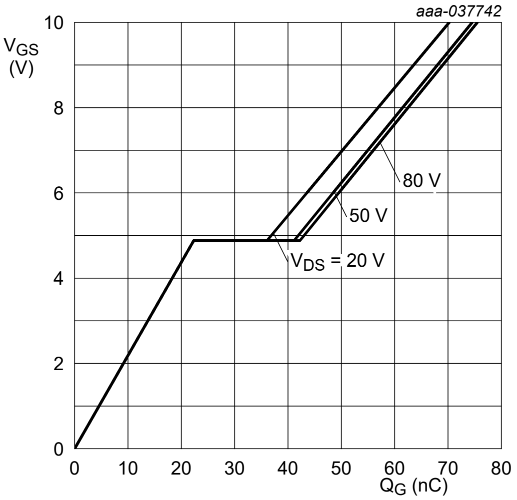

$T_j$ = 25 °C

**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**

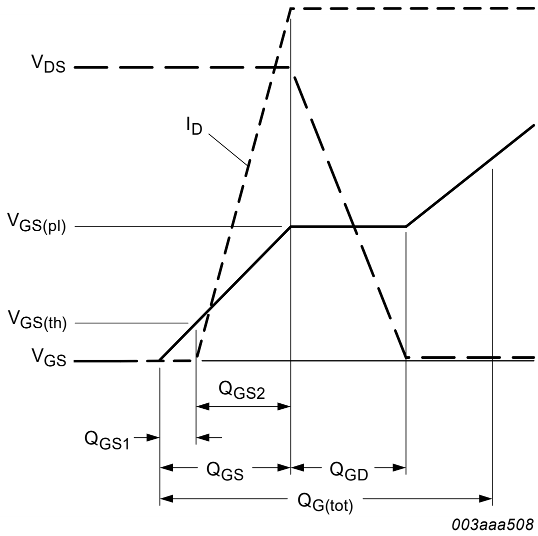
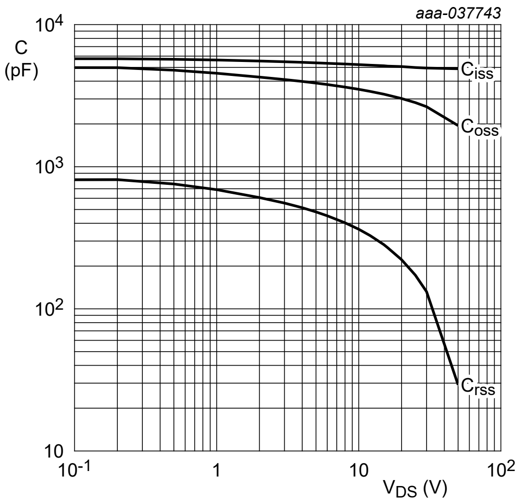
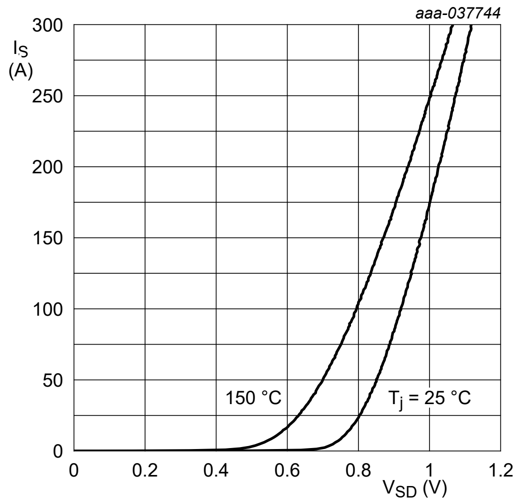



**Fig. 12. Gate charge waveform definitions**




$V_{GS}$ = 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**

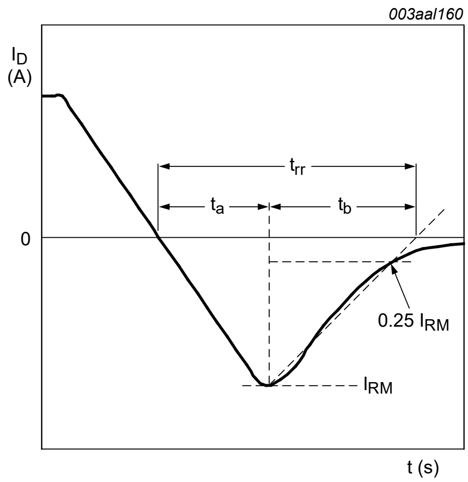
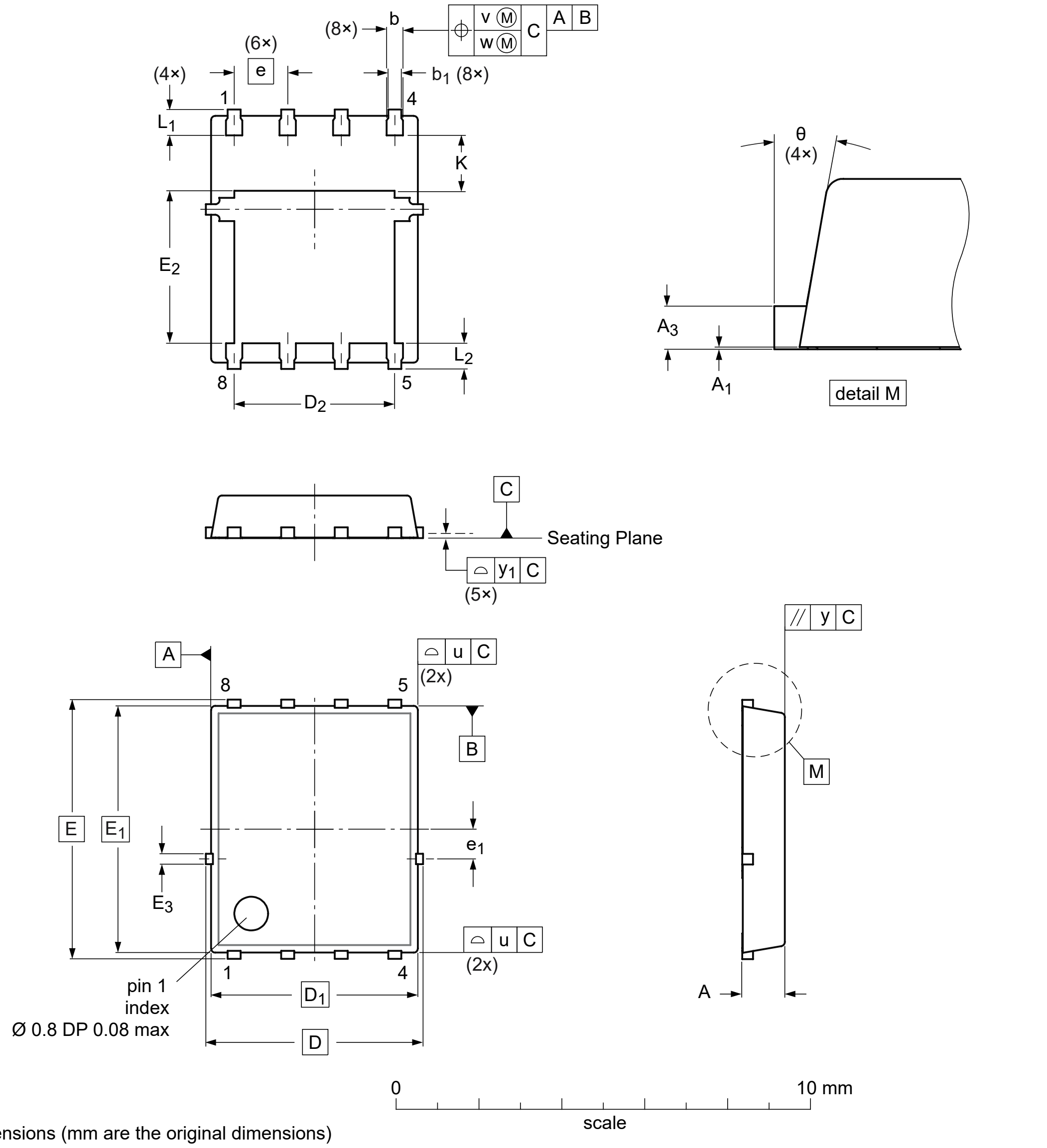



**Fig. 15. Reverse recovery timing definition**

## 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**




| w | θ |
|---|---|
| 0.05 | 12°<br>11°<br>10° |

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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 1.05 | 0.05 | | 0.51 | 0.41 | 5.30 | | 3.9 | 6.30 | | 3.76 | 0.33 | | | | 0.71 | 0.71 | | | | |
| | nom | 1.0 | | 0.254 REF | 0.41 | 0.31 | 5.15 | 5 BSC | 3.8 | 6.15 | 6 BSC | 3.66 | 0.28 | 1.27 BSC | 0.7 REF | 1.3 REF | 0.61 | 0.61 | 0.1 | 0.08 | 0.1 | 0.1 |
| | min | 0.95 | 0 | | 0.31 | 0.21 | 5.00 | | 3.7 | 6.00 | | 3.56 | 0.23 | | | | 0.51 | 0.51 | | | | |

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 | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT8038-1 | | | | | | 24-06-28 |

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

## 12. Soldering

**Footprint information for reflow soldering of MLPAK56 package** **SOT8038-1**

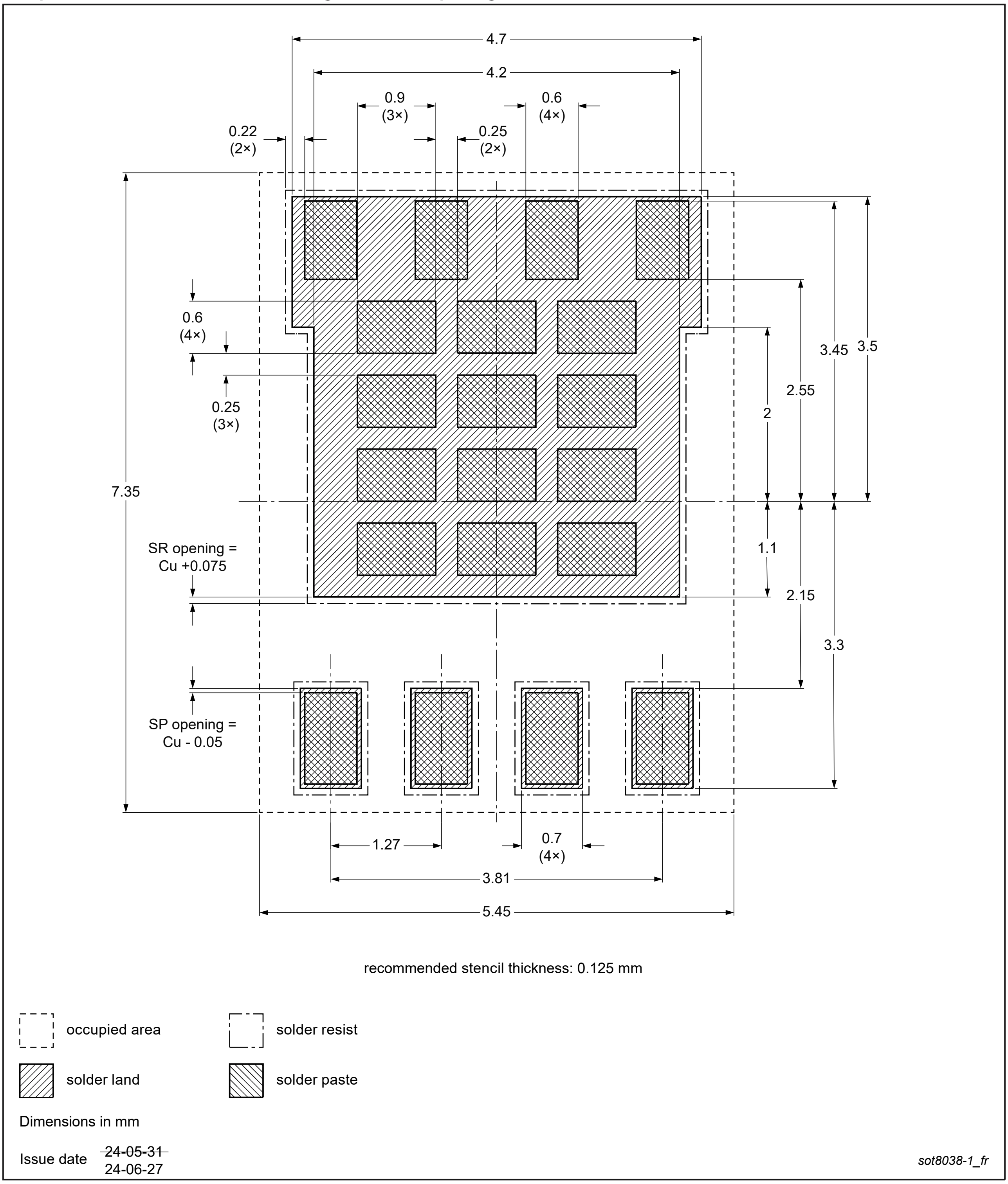



**Fig. 17. Reflow soldering footprint for MLPAK56 (SOT8038-1)**

# 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. |
| Product [short] data sheet | Production | This document contains the product specification. |

[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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