# BUKNS1R4-40MYX8

## 40 V, 1.41 mΩ, Standard Level N-channel MOSFET in MLPAK56-WF Package

**Rev. 1.1 — 24 September 2026** **Product data sheet**

## 1. General Description

Automotive qualified N-channel MOSFET using the latest T2-40 low-ohmic split-gate technology, for ultra-low $R_{DS(on)}$ capability, housed in a MLPAK56 (SOT8038) package. This product has been fully designed and qualified to meet AEC-Q101 requirements delivering high performance and reliability.

## 2. Features and Benefits

Fully automotive qualified to AEC-Q101:

- 175 °C rating suitable for thermally demanding automotive environments

T2-40 split-gate trench technology:

- Reduced cell-pitch enables enhanced power density resulting in lower conduction losses in same footprint

MLPAK micro-leads with side-wettable flanks:

- Proven board-level reliability during thermal cycling
- Visual (AOI) soldering inspection, no need for expensive X-ray equipment
- Easy solder wetting for good mechanical solder joint

MLPAK copper-clip technology:

- Improved reliability with reduced $R_{th}$, $R_{DS(on)}$, and package inductance
- Increases maximum current capability and improves current spreading

## 3. Applications

- 12 V and 24 V high reliability automotive systems
- Motor, lighting, and solenoid control
- Ultra high-performance power switching

## 4. Quick Reference Data

**Table 1. Quick Reference Data**

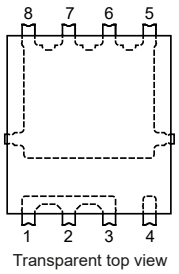
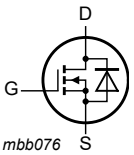
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | 25 °C ≤ $T_j$ ≤ 175 °C | - | - | 40 | V |
| $I_D$ | drain current | $V_{GS}$ = 10 V; $T_{mb}$ = 25 °C; Fig. 2 [1] | - | - | 190 | A |
| **Static Characteristics** | | | | | | |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 10 V; $I_D$ = 25 A; $T_j$ = 25 °C; Fig. 11 | 0.86 | 1.23 | 1.41 | mΩ |
| **Dynamic Characteristics** | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D$ = 25 A; $V_{DS}$ = 32 V; $V_{GS}$ = 10 V; $T_j$ = 25 °C; Fig. 12; Fig. 13 | - | 55 | 66 | nC |

[1] Application tests show a continuous current of 190 A. The PCB, the thermal design, and the operating temperature limit the actual current.

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# 5. Pinning Information

**Table 2. Pinning Information**

| Pin | Symbol | Description | Simplified Outline | Graphic Symbol |
|---|---|---|---|---|
| 1 | S | source |  |  |
| 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 |
| BUKNS1R4-40MYX8 | MLPAK56 | Plastic, thermal enhanced surface mounted package with side-wettable flanks (SWF); minileads; 8 terminals; pitch 1.27 mm; 5.6 × 5.15 × 1.0 mm body | SOT8038-4 |

# 7. Marking

**Table 4. Marking Codes**

| Type Number | Marking Code |
|---|---|
| BUKNS1R4-40MYX8 | BN1S404<br>X8MY |


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# 8. Limiting Values

**Table 5. Limiting Values**

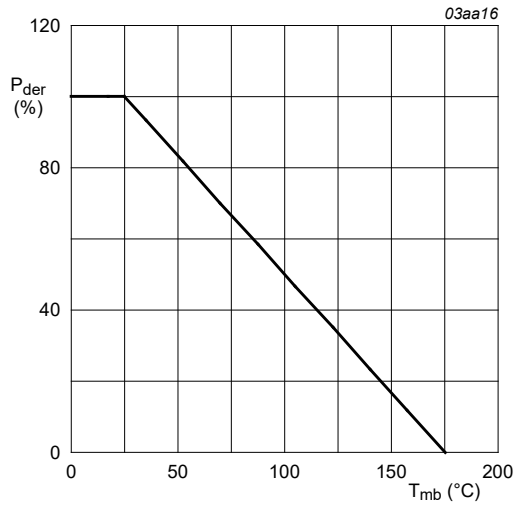
*In accordance with the Absolute Maximum Rating System (IEC 60134). $T_j$ = 25 °C, unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | 25 °C ≤ $T_j$ ≤ 175 °C | - | 40 | V |
| $V_{GS}$ | gate-source voltage | | −20 | 20 | V |
| $P_{tot}$ | total power dissipation | $T_{mb}$ = 25 °C; Fig. 1 | - | 273 | W |
| $I_D$ | drain current | $V_{GS}$ = 10 V; $T_{mb}$ = 25 °C; Fig. 2 [1] | - | 190 | A |
| | | $V_{GS}$ = 10 V; $T_{mb}$ = 100 °C; Fig. 2 | - | 190 | A |
| $I_{DM}$ | peak drain current | pulsed; $t_p$ ≤ 10 µs; $T_{mb}$ = 25 °C; Fig. 3 [1] | - | 911 | A |
| $T_{stg}$ | storage temperature | | −55 | 175 | °C |
| $T_j$ | junction temperature | | −55 | 175 | °C |
| **Source-drain Diode** | | | | | |
| $I_S$ | source current | $T_{mb}$ = 25 °C | - | 190 | A |
| $I_{SM}$ | peak source current | pulsed; $t_p$ ≤ 10 µs; $T_{mb}$ = 25 °C | - | 911 | A |
| **Avalanche Ruggedness** | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D$ = 52 A; $V_{sup}$ ≤ 40 V; $R_{GS}$ = 50 Ω; $V_{GS}$ = 10 V; $T_{j(init)}$ = 25 °C; unclamped; Fig. 4 [2] | - | 136 | mJ |
| $I_{AS}$ | non-repetitive avalanche current | $V_{sup}$ ≤ 40 V; $V_{GS}$ = 10 V; $T_{j(init)}$ = 25 °C; $R_{GS}$ = 50 Ω; Fig. 4 [3] | - | 190 | A |

[1] Application tests show a continuous current of 190 A. The PCB, the thermal design, and the operating temperature limit the actual current.

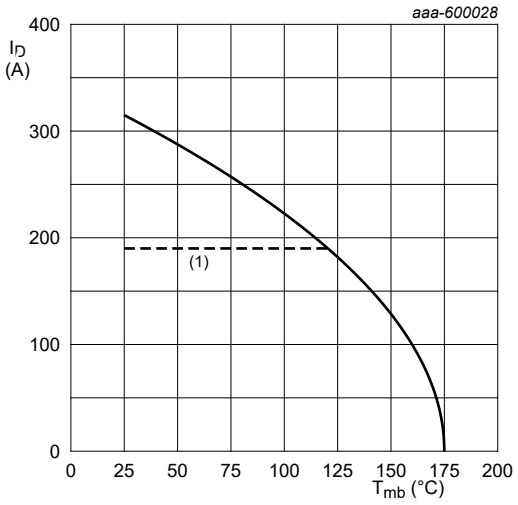
[2] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C. Refer to AN10273 for further information.

[3] 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**



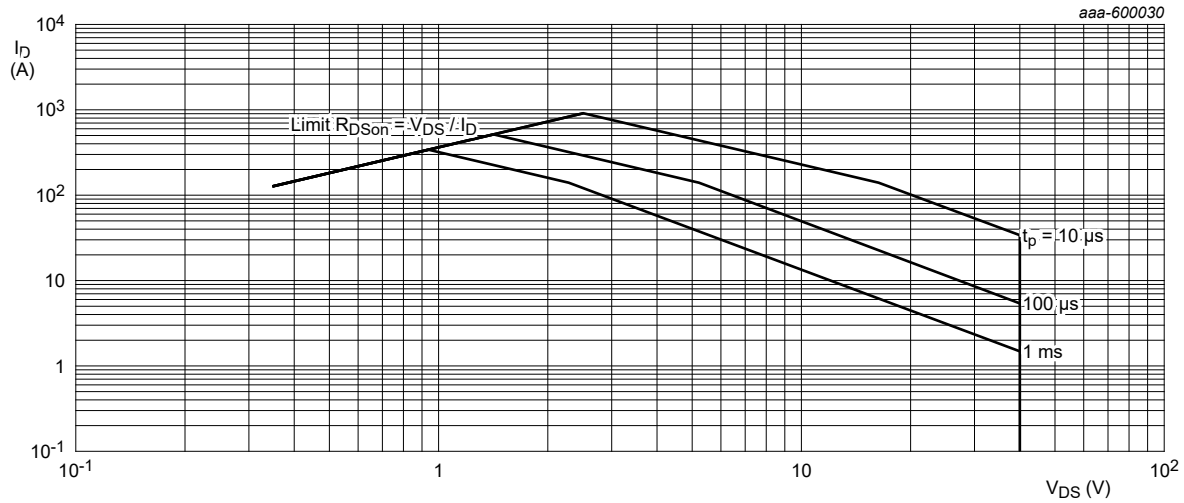

(1) $V_{GS}$ ≥ 10 V

Application tests show a continuous current of 190 A. The PCB, the thermal design, and the operating temperature limit the actual current.

**Fig. 2. Continuous Drain Current as a Function of Mounting Base Temperature**

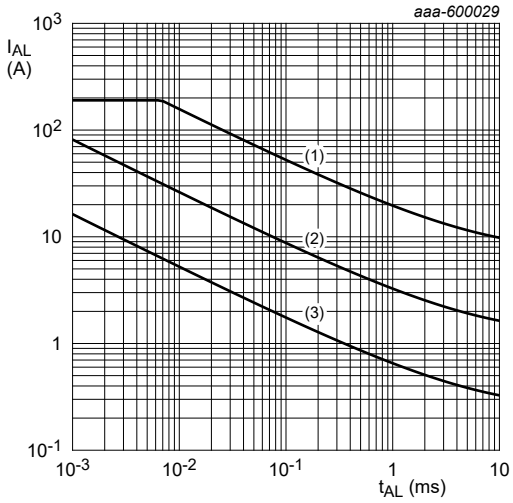

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$T_{mb}$ = 25 °C; $I_{DM}$ is a single pulse.

**Fig. 3. Safe Operating Area; Continuous and Peak Drain Currents as a Function of Drain-source Voltage**




- (1) $T_{j(init)}$ = 25 °C
- (2) $T_{j(init)}$ = 150 °C
- (3) Repetitive Avalanche

**Fig. 4. Avalanche Rating; Avalanche Current as a Function of Avalanche Time**

# 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 | - | 0.42 | 0.55 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient[1] | | - | 24 | - | K/W |

[1] The device is placed on a 2s2p FR4 PCB as defined by the JEDEC standards (JESD51-5, -7). The PCB is placed vertically in still air.


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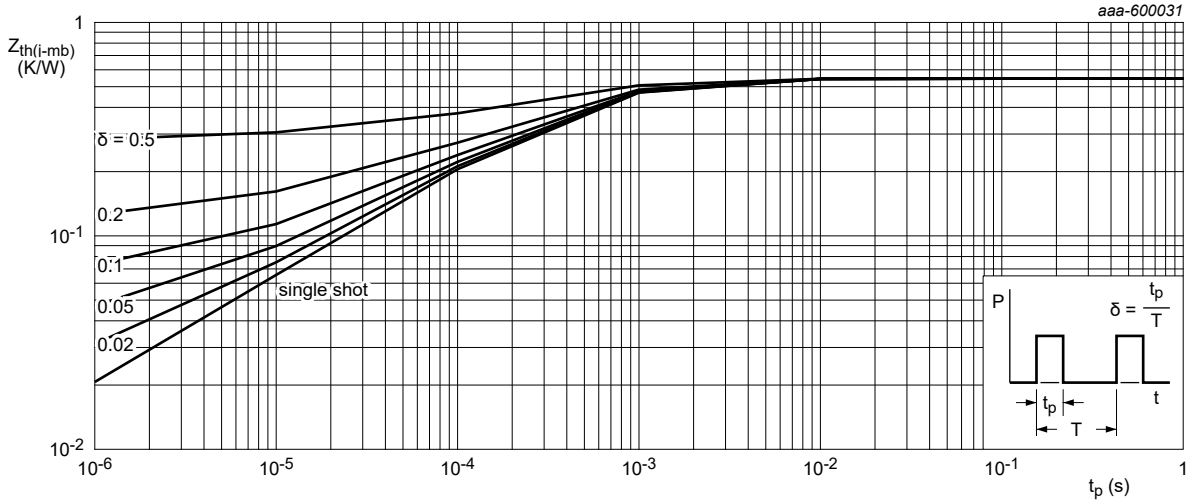



**Fig. 5. Transient Thermal Impedance from Junction to Mounting Base as a Function of Pulse Duration**


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# 10. Characteristics

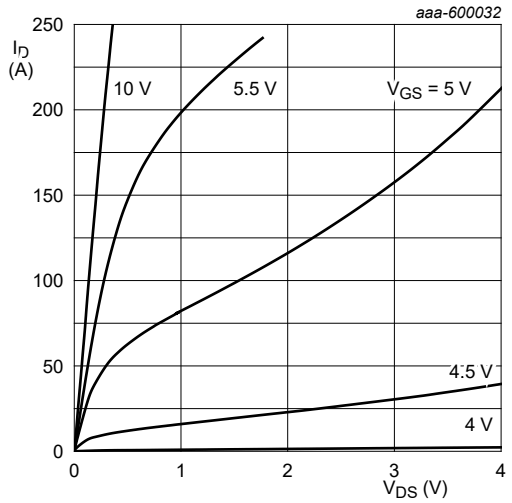
**Table 7. Characteristics**

| 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 | 40 | 43 | - | V |
| | | $I_D$ = 250 µA; $V_{GS}$ = 0 V; $T_j$ = −40 °C | - | 42.5 | - | V |
| | | $I_D$ = 250 µA; $V_{GS}$ = 0 V; $T_j$ = −55 °C | 36 | 42.2 | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D$ = 0.3 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 25 °C; Fig. 8; Fig. 9 | 2.3 | 3 | 3.7 | V |
| | | $I_D$ = 0.3 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = −55 °C; Fig. 9 | - | - | 4.1 | V |
| | | $I_D$ = 0.3 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 175 °C; Fig. 9 | 1 | - | - | V |
| $I_{DSS}$ | drain leakage current | $V_{DS}$ = 40 V; $V_{GS}$ = 0 V; $T_j$ = 25 °C | - | 0.05 | 1 | µA |
| | | $V_{DS}$ = 16 V; $V_{GS}$ = 0 V; $T_j$ = 125 °C | - | 3 | 10 | µA |
| | | $V_{DS}$ = 40 V; $V_{GS}$ = 0 V; $T_j$ = 175 °C | - | 50 | 200 | µA |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = 20 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | - | 5 | 100 | nA |
| | | $V_{GS}$ = −20 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | - | 10 | 100 | nA |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 10 V; $I_D$ = 25 A; $T_j$ = 25 °C; Fig. 10 | 0.86 | 1.23 | 1.41 | mΩ |
| | | $V_{GS}$ = 10 V; $I_D$ = 25 A; $T_j$ = 105 °C; Fig. 11 | 1.12 | 1.6 | 2.12 | mΩ |
| | | $V_{GS}$ = 10 V; $I_D$ = 25 A; $T_j$ = 125 °C; Fig. 11 | 1.22 | 1.74 | 2.33 | mΩ |
| | | $V_{GS}$ = 10 V; $I_D$ = 25 A; $T_j$ = 175 °C; Fig. 11 | 1.47 | 2.1 | 2.75 | mΩ |
| $R_G$ | gate resistance | f = 1 MHz; $T_j$ = 25 °C | 0.1 | 0.5 | 1.0 | Ω |
| **Dynamic Characteristics** | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D$ = 25 A; $V_{DS}$ = 32 V; $V_{GS}$ = 10 V; $T_j$ = 25 °C; Fig. 12; Fig. 13 | - | 55 | 66 | nC |
| $Q_{GS}$ | gate-source charge | | - | 15 | 22 | nC |
| $Q_{GD}$ | gate-drain charge | | - | 12 | 17 | nC |
| $C_{iss}$ | input capacitance | $V_{DS}$ = 25 V; $V_{GS}$ = 0 V; f = 1 MHz; $T_j$ = 25 °C; Fig. 14 | - | 3776 | 5664 | pF |
| $C_{oss}$ | output capacitance | | - | 1049 | 1574 | pF |
| $C_{rss}$ | reverse transfer capacitance | | - | 16 | 24 | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS}$ = 32 V; $R_L$ = 1.3 Ω; $V_{GS}$ = 10 V; $R_{G(ext)}$ = 5 Ω; $T_j$ = 25 °C | - | 20.6 | - | ns |
| $t_r$ | rise time | | - | 11.4 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 42.7 | - | ns |
| $t_f$ | fall time | | - | 11.8 | - | ns |
| **Source-drain Diode** | | | | | | |
| $V_{SD}$ | source-drain voltage | $I_S$ = 25 A; $V_{GS}$ = 0 V; $T_j$ = 25 °C; Fig. 15 | - | 0.8 | 1 | V |
| $t_{rr}$ | reverse recovery time | $I_S$ = 25 A; $di_S/dt$ = −100 A/µs; $V_{GS}$ = 0 V; $V_{DS}$ = 20 V; $T_j$ = 25 °C; Fig. 16 [1] | - | 52.1 | - | ns |
| $Q_r$ | recovered charge | | - | 67.7 | - | nC |

[1] Includes capacitive recovery

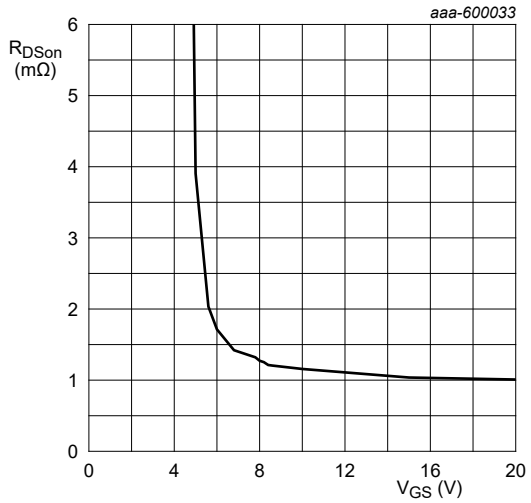

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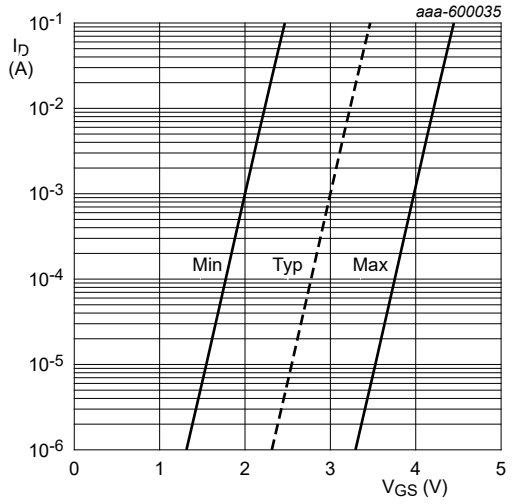

$T_j$ = 25 °C

**Fig. 6. Output Characteristics; Drain Current as a Function of Drain-source Voltage; Typical Values**



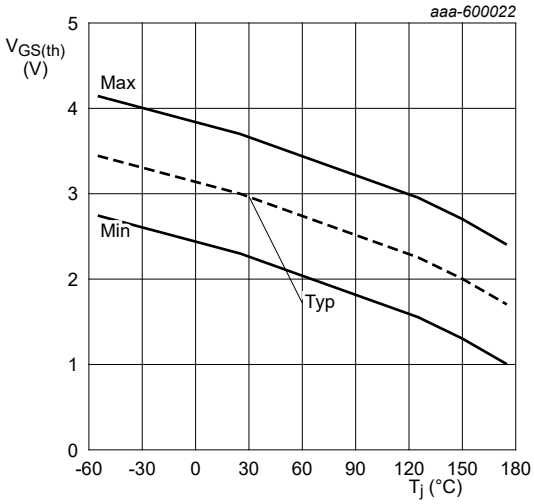

$T_j$ = 25 °C; $I_D$ = 25 A

**Fig. 7. Drain-source On-state Resistance 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**

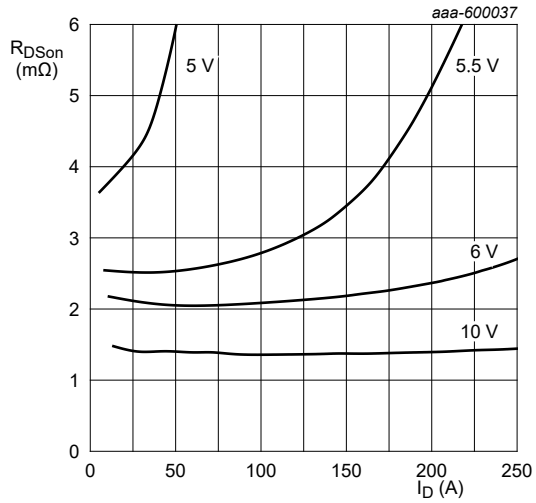



$I_D$ = 0.3 mA; $V_{DS}$ = $V_{GS}$

**Fig. 9. Gate-source Threshold Voltage as a Function of Junction Temperature**

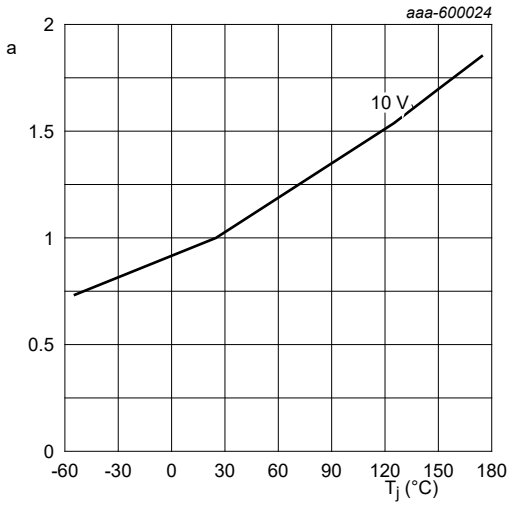

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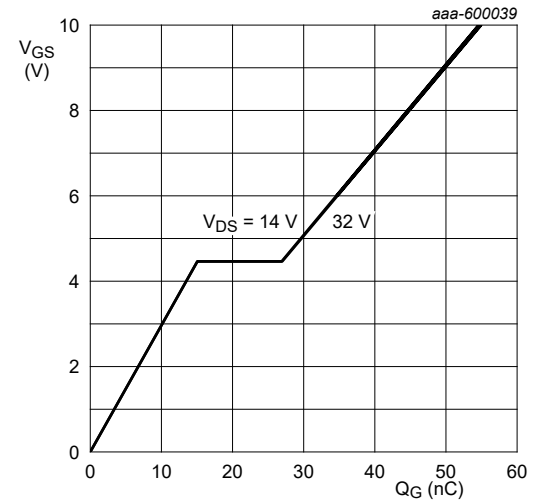

$T_j$ = 25 °C

**Fig. 10. Drain-source On-state Resistance as a Function of Drain Current; Typical Values**




$$a = \frac{R_{DS(on)}}{R_{DS(on)(25\,°C)}}$$

**Fig. 11. Normalized Drain-source On-state Resistance Factor as a Function of Junction Temperature**




$T_j$ = 25 °C; $I_D$ = 25 A

**Fig. 12. Gate-source Voltage as a Function of Gate Charge; Typical Values**

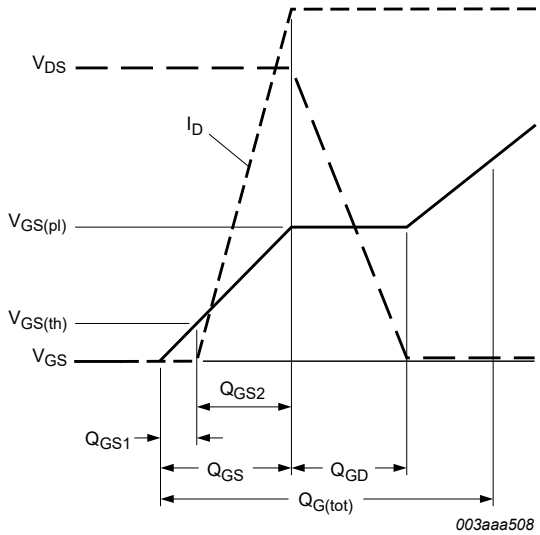
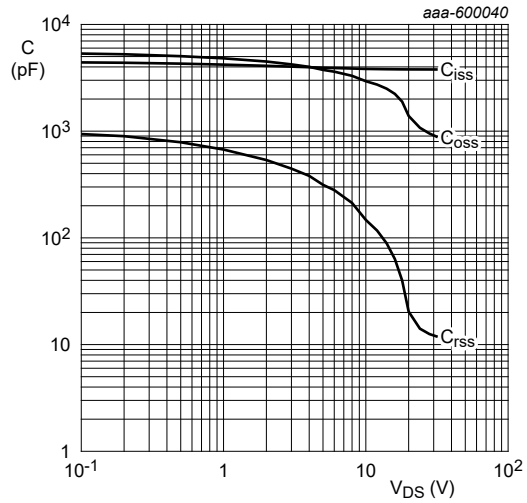



**Fig. 13. Gate Charge Waveform Definitions**

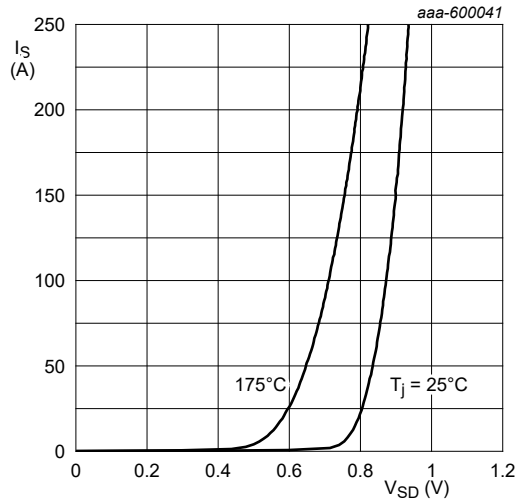

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$V_{GS}$ = 0 V; f = 1 MHz

**Fig. 14. Input, Output, and Reverse Transfer Capacitances as a Function of Drain-source Voltage; Typical Values**




$V_{GS}$ = 0 V

**Fig. 15. Source-drain (Diode Forward) Current as a Function of Source-drain (Diode Forward) Voltage; Typical Values**

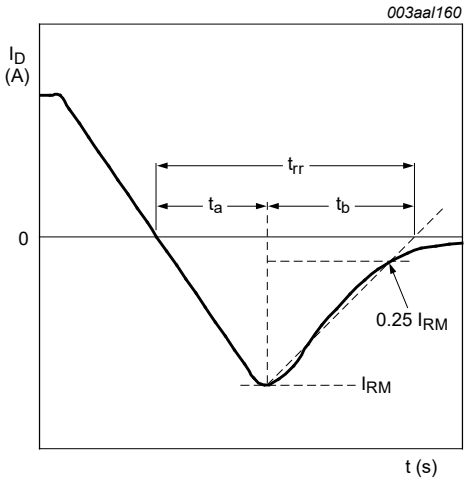


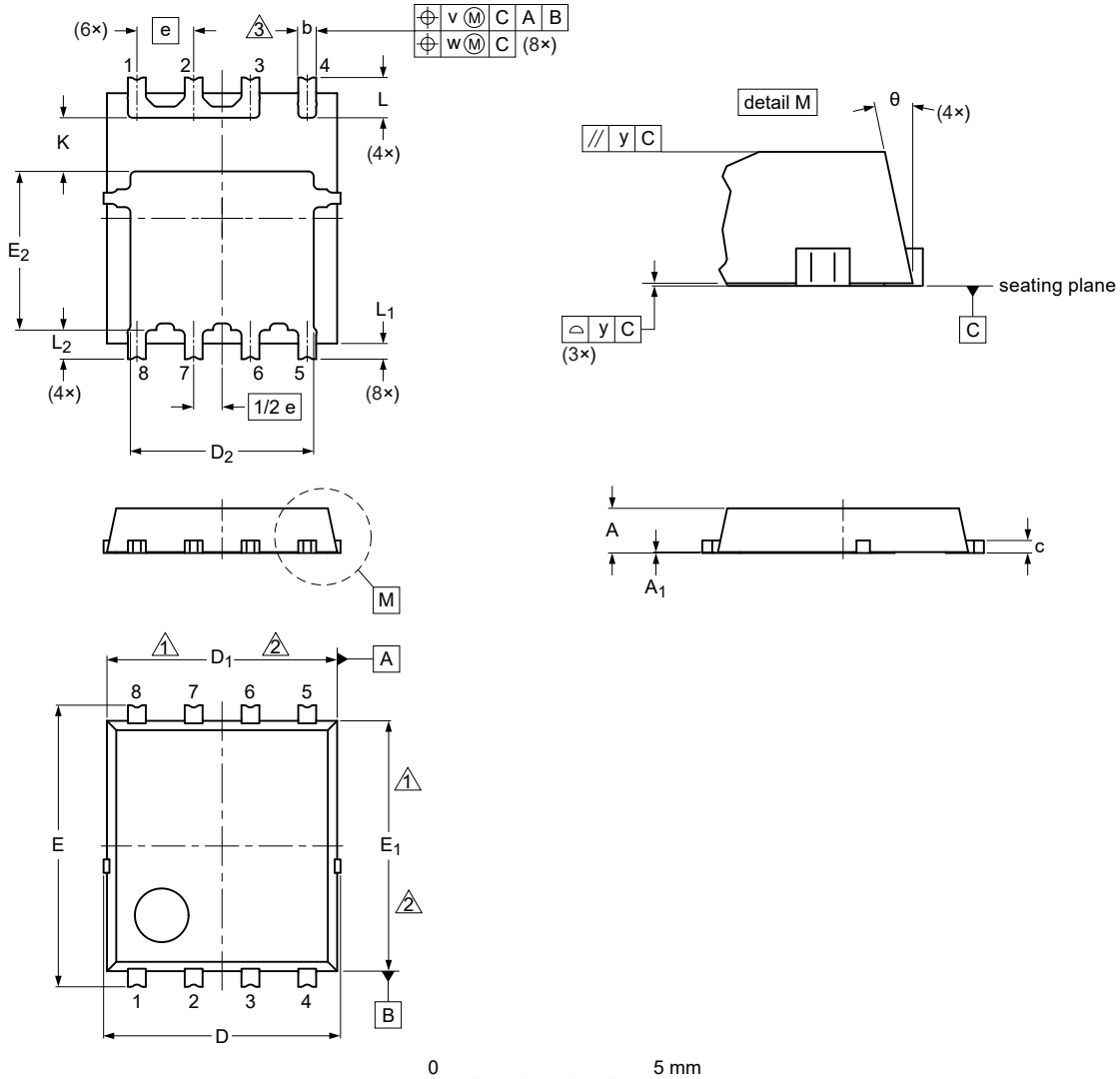

**Fig. 16. Reverse Recovery Timing Definition**


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# 11. Package Outline

**MLPAK56: Plastic, thermal enhanced surface mounted package with side-wettable flanks (SWF); minileads; 8 terminals; pitch 1.27 mm; 5.6 x 5.15 x 1.0 mm body** **SOT8038-4**




Dimensions (mm are the original dimensions)

| Unit[1] | | A | $A_1$ | b | c | D | $D_1$ | $D_2$ | E | $E_1$ | $E_2$ | e | K | L | $L_1$ | $L_2$ | v | w | y | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 1.1 | 0.05 | 0.52 | 0.33 | 5.45 | 5.25 | 4.25 | 6.45 | 5.75 | 3.65 | 1.27 BSC | 1.2 REF | 1.00 | 0.35 REF | 0.75 | 0.1 | 0.05 | 0.1 | 12° |
| | nom | 1.0 | | | 0.28 | | 5.15 | 4.10 | 6.30 | 5.60 | 3.55 | | | 0.90 | | 0.65 | | | | |
| | min | 0.9 | 0 | 0.34 | 0.23 | 5.15 | 5.05 | 3.95 | 6.15 | 5.45 | 3.45 | | | 0.80 | | 0.55 | | | | 0° |

Note
1. Dimension does not include mold flash, plastic protrusion or gate burrs. These shall not exceed 0.15 mm per end.
2. Dimension does not include interterminal flash or protrusion which shall not exceed 0.25 mm per side.
3. Dimension does not include metal protrusion or burr which shall not exceed 0.075 mm per lead side.

*sot8038-4_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT8038-4 | | | | | | 24-12-12 |

**Fig. 17. Package Outline MLPAK56 (SOT8038-4)**


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# 12. Soldering

**Table 8. Soldering**

| Footprint information for reflow soldering of MLPAK56 package | SOT8038-4 |
|---|---|

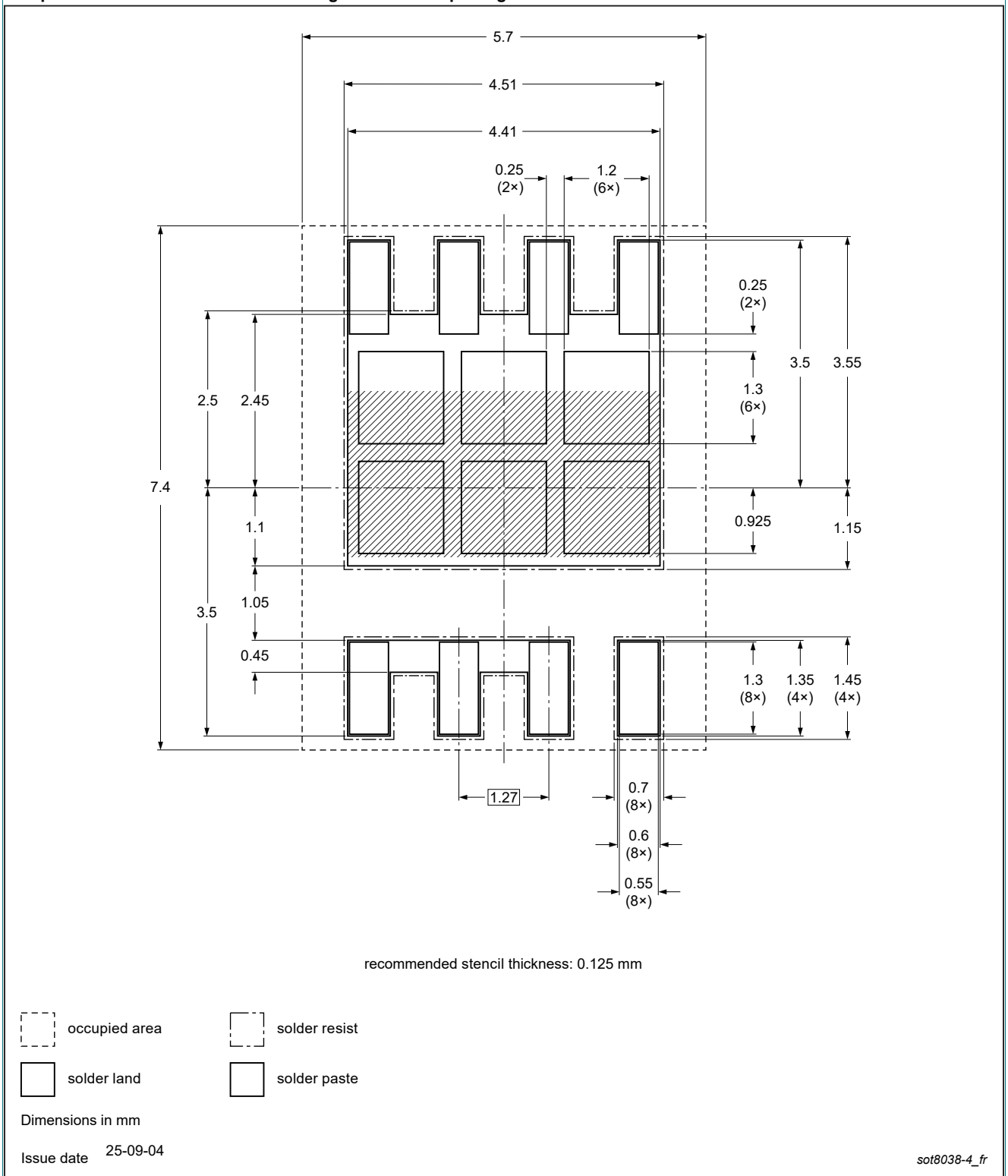



**Fig. 18. Reflow Soldering Footprint for MLPAK56 (SOT8038-4)**


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# 13. Revision History

**Table 9. Revision History**

| Document ID | Release Date | Change Description |
|---|---|---|
| BUKNS1R4-40MYX8 V. 1.1 | 20260924 | Minor editorial updates. |
| BUKNS1R4-40MYX8 V. 1 | 20260722 | Initial release |


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# 14. 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".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com.

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