



BUK4D72-30

30 V, N-channel Trench MOSFET

27 March 2023

Product data sheet

1. General description

N-channel enhancement mode Field-Effect Transistor (FET) in a leadless medium power DFN2020MD-6 (SOT1220) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

2. Features and benefits

- Extended temperature range $T_j = 175\text{ °C}$
- Small and leadless ultra thin SMD plastic package: 2 x 2 x 0.65 mm
- Tin-plated 100% solderable side pads for optical solder inspection
- ElectroStatic Discharge (ESD) protection > 1.5 kV HBM
- Trench MOSFET technology
- AEC-Q101 qualified

3. Applications

- Relay driver
- High-speed line driver
- Low-side load switch
- Switching circuits

4. Quick reference data

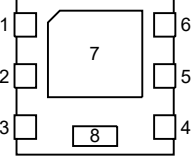
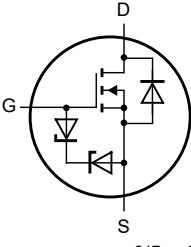
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------|----------------------------------|---|-----|-----|-----|------|
| V_{DS} | drain-source voltage | $T_j = 25\text{ °C}$ | - | - | 30 | V |
| V_{GS} | gate-source voltage | | -12 | - | 12 | V |
| I_D | drain current | $V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ °C}$ | [1] | - | 3.8 | A |
| Static characteristics | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}; I_D = 3.8\text{ A}; T_j = 25\text{ °C}$ | - | 55 | 72 | mΩ |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm².

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------|---|--|
| 1 | D | drain |  <p>Transparent top view DFN2020MD-6 (SOT1220)</p> |  <p>017aaa255</p> |
| 2 | D | drain | | |
| 3 | G | gate | | |
| 4 | S | source | | |
| 5 | D | drain | | |
| 6 | D | drain | | |
| 7 | D | drain | | |
| 8 | S | source | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|-------------|---|---------|
| | Name | Description | Version |
| BUK4D72-30 | DFN2020MD-6 | plastic, leadless thermal enhanced ultra thin small outline package with side-wettable flanks (SWF); 6 terminals; 0.65 mm pitch; 2 mm x 2 mm x 0.65 mm body | SOT1220 |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| BUK4D72-30 | 6G |

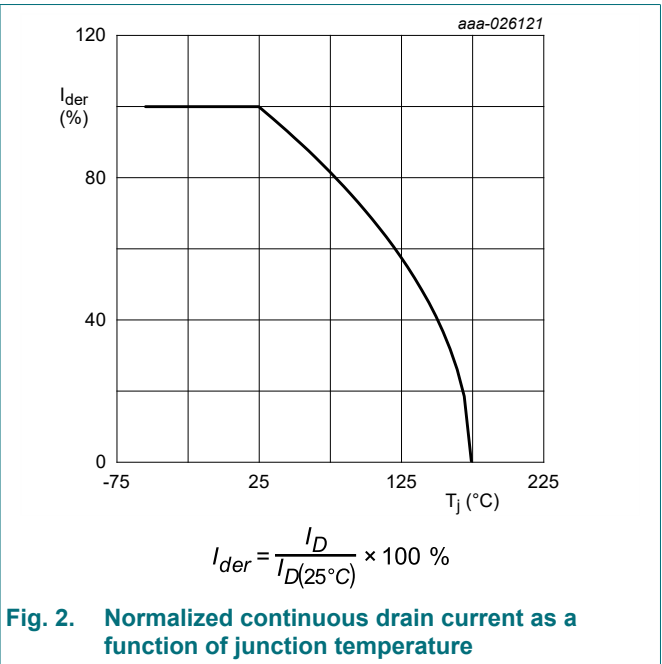
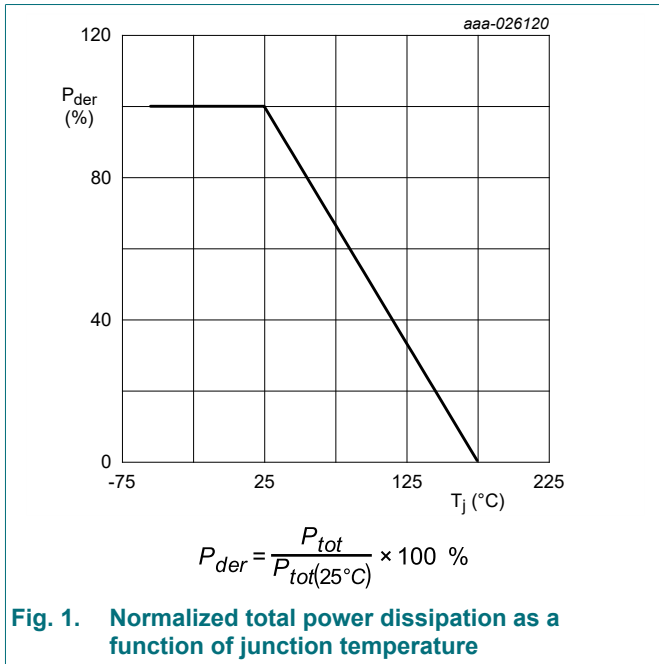
8. Limiting values

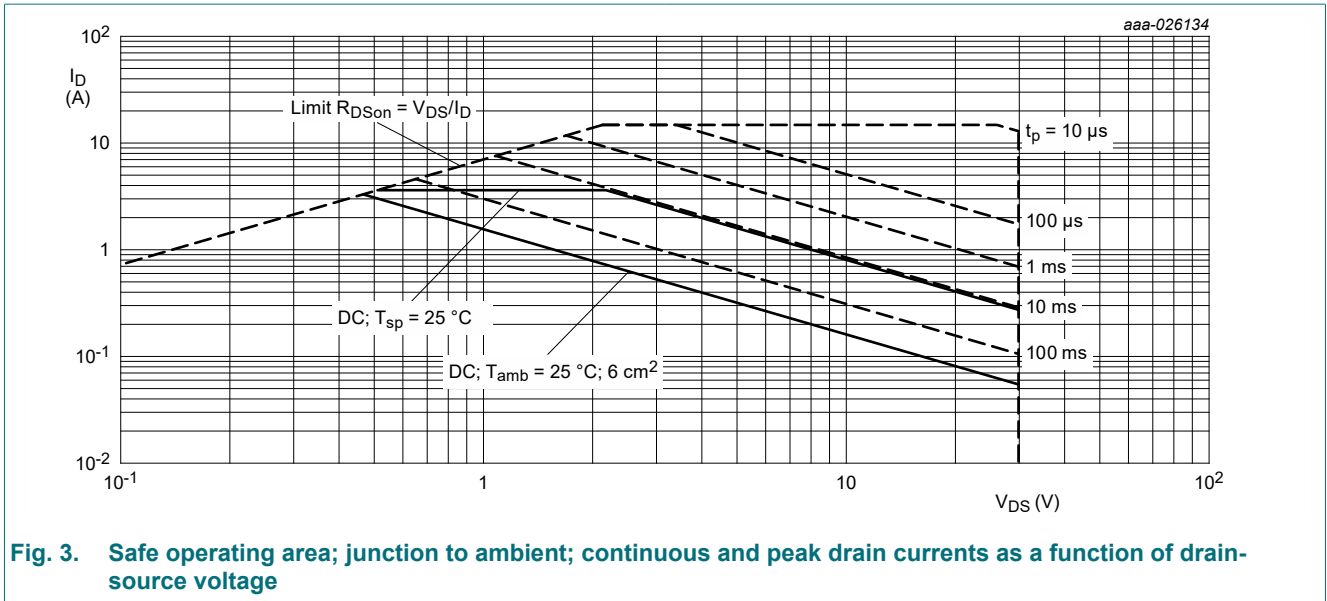
Table 5. Limiting values

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

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---------------------------|--|---|-----|-----|------|------|
| V _{DS} | drain-source voltage | T _j = 25 °C | | - | 30 | V |
| V _{GS} | gate-source voltage | | | -12 | 12 | V |
| I _D | drain current | V _{GS} = 4.5 V; T _{amb} = 25 °C | [1] | - | 3.8 | A |
| | | V _{GS} = 4.5 V; T _{amb} = 100 °C | [1] | - | 2.4 | A |
| I _{DM} | peak drain current | T _{amb} = 25 °C; single pulse; t _p ≤ 10 μs | | - | 16 | A |
| P _{tot} | total power dissipation | T _{amb} = 25 °C | [2] | - | 550 | mW |
| | | | [1] | - | 1.95 | W |
| | | T _{sp} = 25 °C | | - | 10 | W |
| T _j | junction temperature | | | -55 | 175 | °C |
| T _{amb} | ambient temperature | | | -55 | 175 | °C |
| T _{stg} | storage temperature | | | -65 | 175 | °C |
| E _{DS(AL)S} | non-repetitive drain-source avalanche energy | T _{j(initial)} = 25 °C; I _D = 0.3 A; DUT in avalanche (unclamped) | | - | 6.2 | mJ |
| Source-drain diode | | | | | | |
| I _S | source current | T _{amb} = 25 °C | [1] | - | 1.9 | A |
| ESD maximum rating | | | | | | |
| V _{ESD} | electrostatic discharge voltage | HBM | [3] | - | 1500 | V |

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm².
- [2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper; tin-plated and standard footprint.
- [3] Measures between all pins.





9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|----------------|--|-------------|-----|-----|-----|-----|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | 236 | 272 | K/W |
| | | | [2] | - | 67 | 77 | K/W |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | | - | 12 | 15 | K/W |

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 6 cm².

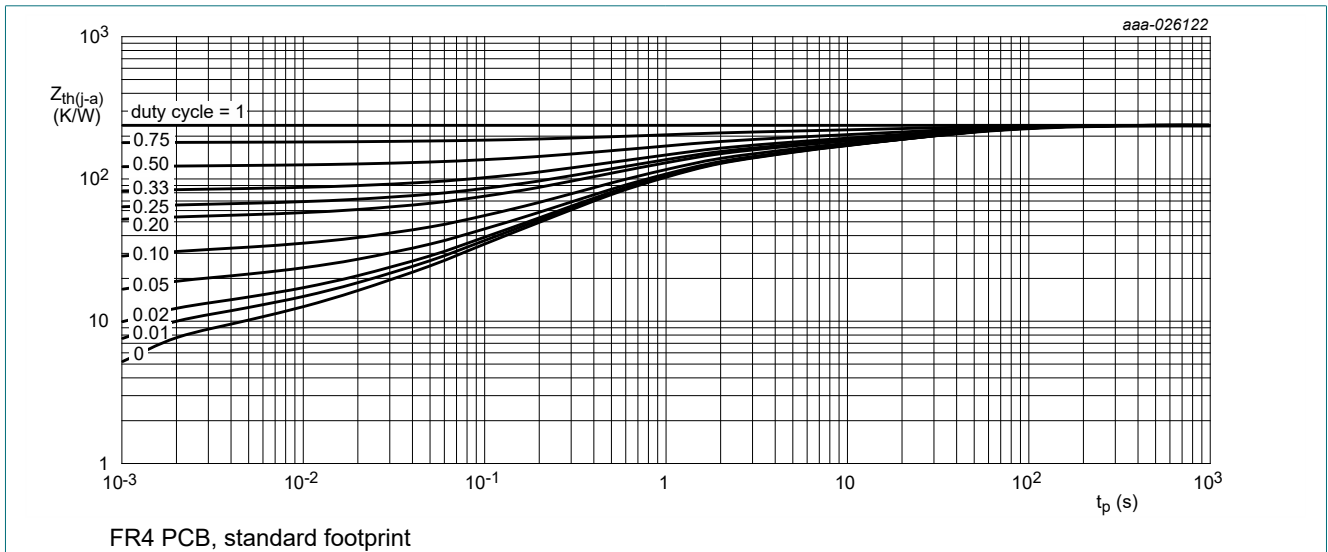


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

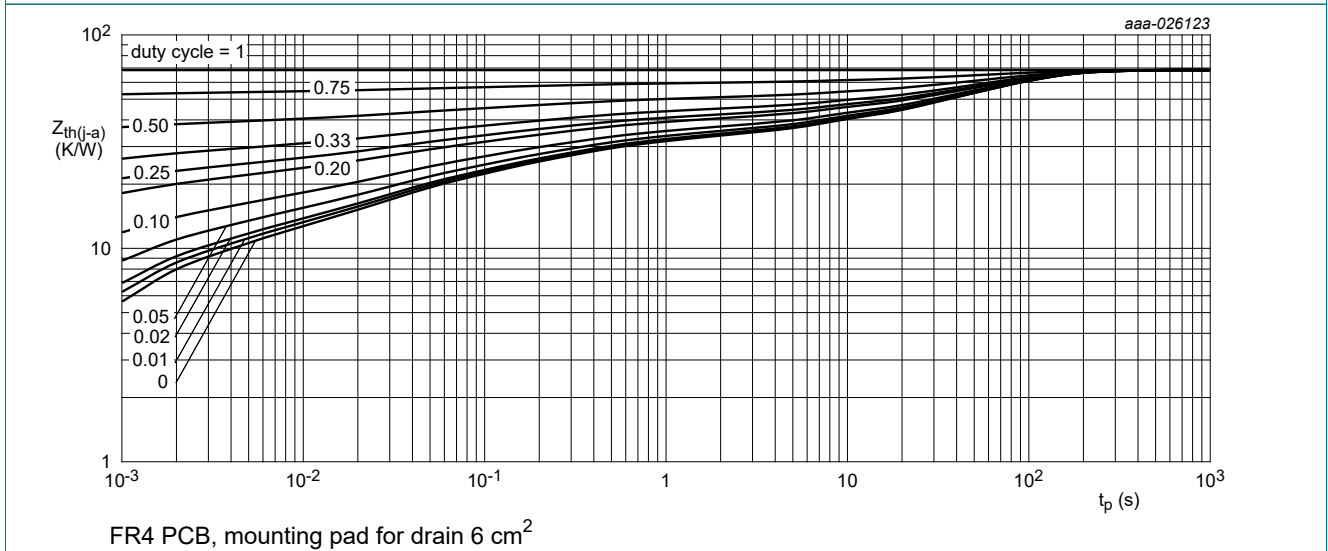


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|--|------|------|------|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 250 \mu\text{A}$; $V_{GS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | 30 | - | - | V |
| V_{GSth} | gate-source threshold voltage | $I_D = 250 \mu\text{A}$; $V_{DS} = V_{GS}$; $T_j = 25 \text{ }^\circ\text{C}$ | 0.75 | 1 | 1.25 | V |
| I_{DSS} | drain leakage current | $V_{DS} = 30 \text{ V}$; $V_{GS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | - | 1 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 12 \text{ V}$; $V_{DS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | - | 10 | μA |
| | | $V_{GS} = -12 \text{ V}$; $V_{DS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | - | -10 | μA |
| | | $V_{GS} = 4.5 \text{ V}$; $V_{DS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | - | 2 | μA |
| | | $V_{GS} = -4.5 \text{ V}$; $V_{DS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | - | -2 | μA |
| R_{DSon} | drain-source on-state resistance | $V_{GS} = 4.5 \text{ V}$; $I_D = 3.8 \text{ A}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 55 | 72 | m Ω |
| | | $V_{GS} = 4.5 \text{ V}$; $I_D = 3.8 \text{ A}$; $T_j = 175 \text{ }^\circ\text{C}$ | - | 102 | 133 | m Ω |
| | | $V_{GS} = 2.5 \text{ V}$; $I_D = 3.1 \text{ A}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 77 | 110 | m Ω |
| g_{fs} | forward transconductance | $V_{DS} = 10 \text{ V}$; $I_D = 3.8 \text{ A}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 20 | - | S |
| R_G | gate resistance | $f = 1 \text{ MHz}$ | - | 10.8 | - | Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $V_{DS} = 15 \text{ V}$; $I_D = 3.6 \text{ A}$; $V_{GS} = 4.5 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 3 | 5 | nC |
| Q_{GS} | gate-source charge | | - | 0.5 | - | nC |
| Q_{GD} | gate-drain charge | | - | 0.9 | - | nC |
| C_{iss} | input capacitance | $V_{DS} = 15 \text{ V}$; $f = 1 \text{ MHz}$; $V_{GS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 255 | - | pF |
| C_{oss} | output capacitance | | - | 31 | - | pF |
| C_{rss} | reverse transfer capacitance | | - | 23 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 15 \text{ V}$; $I_D = 3.6 \text{ A}$; $V_{GS} = 4.5 \text{ V}$; $R_{G(ext)} = 6 \text{ } \Omega$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 7 | - | ns |
| t_r | rise time | | - | 20 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 18 | - | ns |
| t_f | fall time | | - | 8 | - | ns |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 1.9 \text{ A}$; $V_{GS} = 0 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 0.8 | 1.2 | V |
| t_{rr} | reverse recovery time | $I_S = 2.5 \text{ A}$; $dI_S/dt = -100 \text{ A}/\mu\text{s}$; $V_{GS} = 0 \text{ V}$; $V_{DS} = 10 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$ | - | 12.6 | - | ns |
| Q_r | recovered charge | | - | 4 | - | nC |

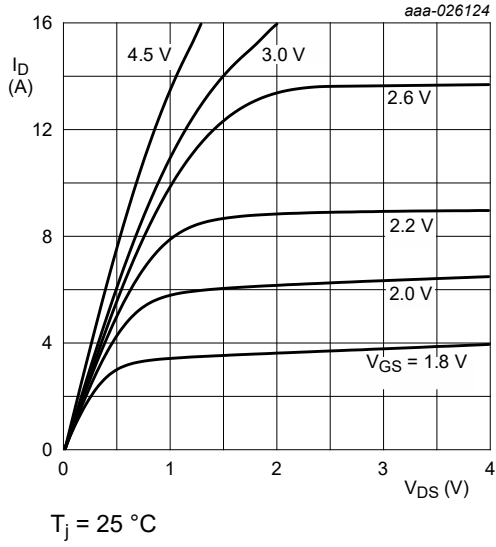


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

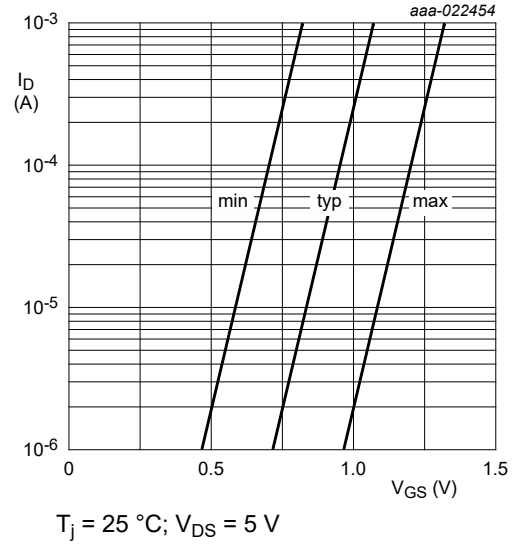


Fig. 7. Subthreshold drain current as a function of gate-source voltage

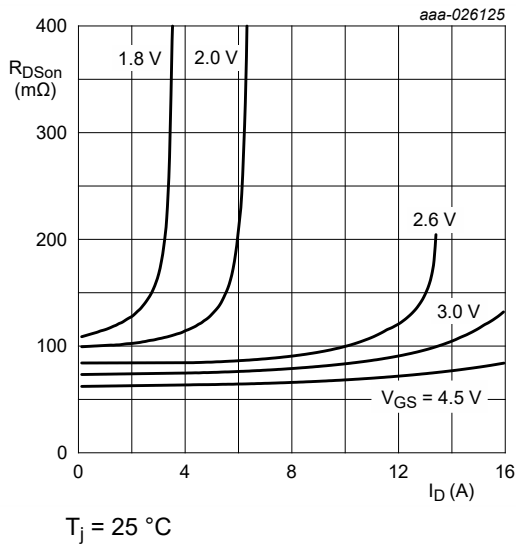


Fig. 8. Drain-source on-state resistance as a function of gate-source voltage; typical values

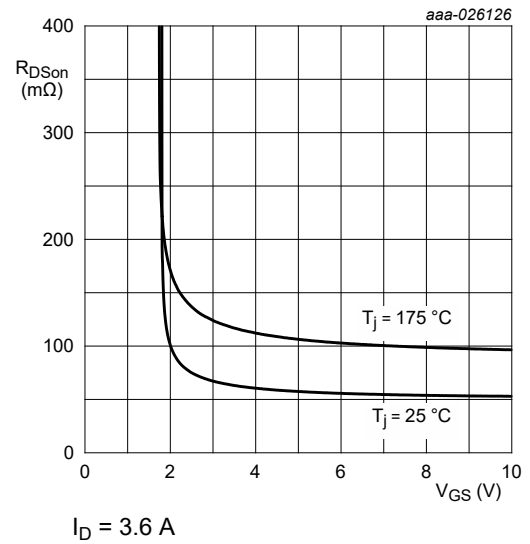
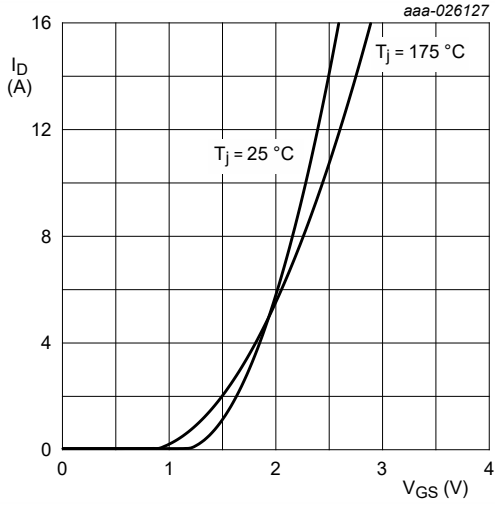
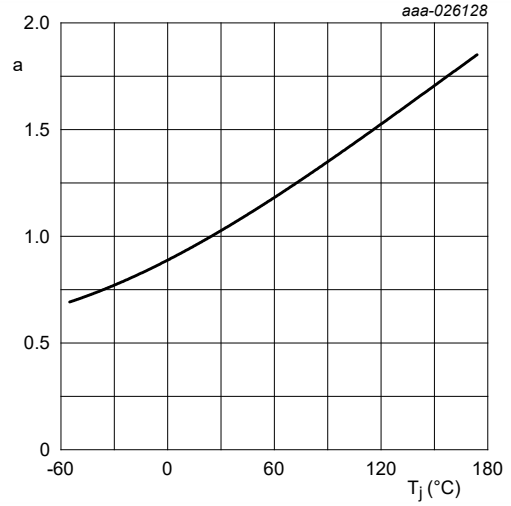


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



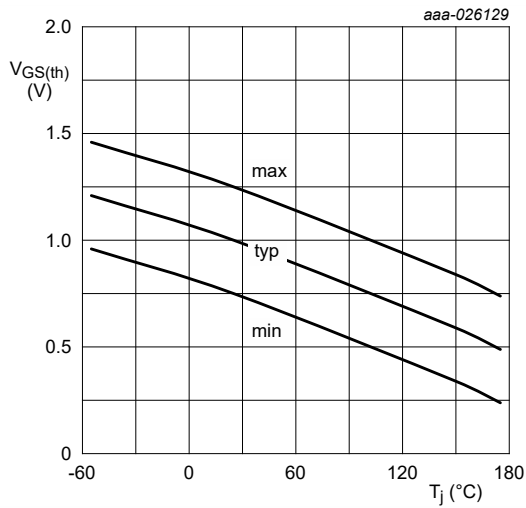
$$V_{DS} > I_D \times R_{DSon}$$

Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values



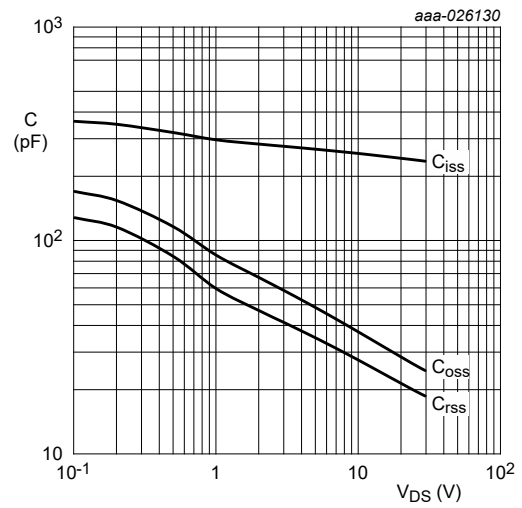
$$a = \frac{R_{DSon}}{R_{DSon}(25^\circ\text{C})}$$

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



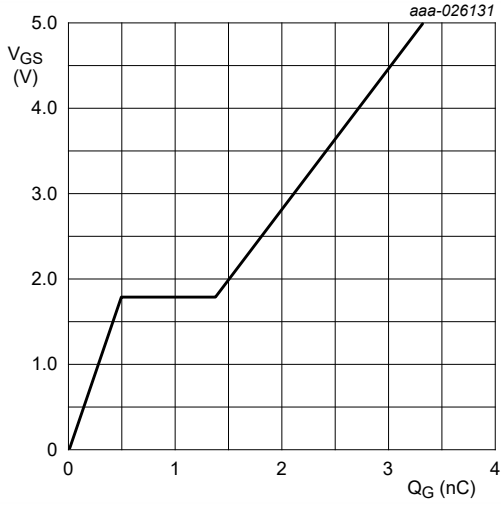
$$I_D = 250 \mu\text{A}; V_{DS} = V_{GS}$$

Fig. 12. Gate-source threshold voltage as a function of junction temperature



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

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



$V_{DS} = 15 \text{ V}; I_D = 3.6 \text{ A}; T_{amb} = 25 \text{ }^\circ\text{C}$

Fig. 14. Gate-source voltage as a function of gate charge; typical values

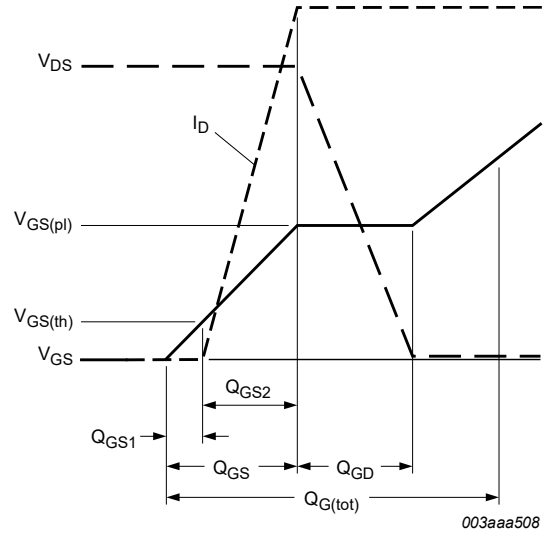
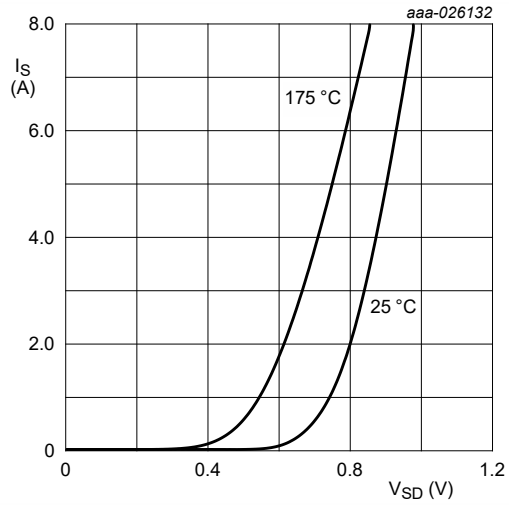


Fig. 15. Gate charge waveform definitions



$V_{GS} = 0 \text{ V}$

Fig. 16. Source current as a function of source-drain voltage; typical values

11. Test information



Fig. 17. Duty cycle definition

Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - *Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

12. Package outline

DFN2020MD-6: plastic thermal enhanced ultra thin small outline package; no leads;
6 terminals; body 2 x 2 x 0.65 mm

SOT1220

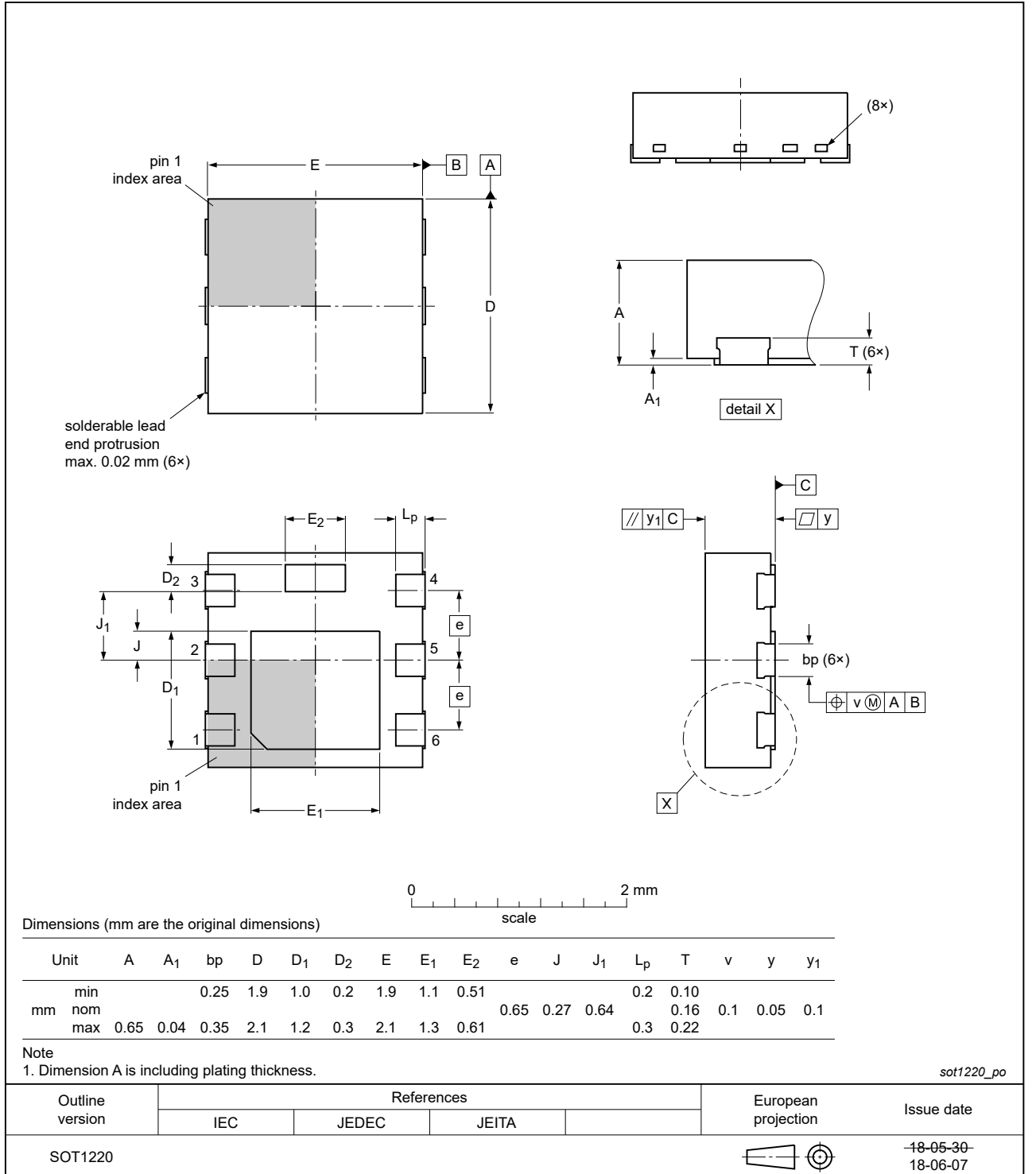


Fig. 18. Package outline DFN2020MD-6 (SOT1220)

13. Soldering

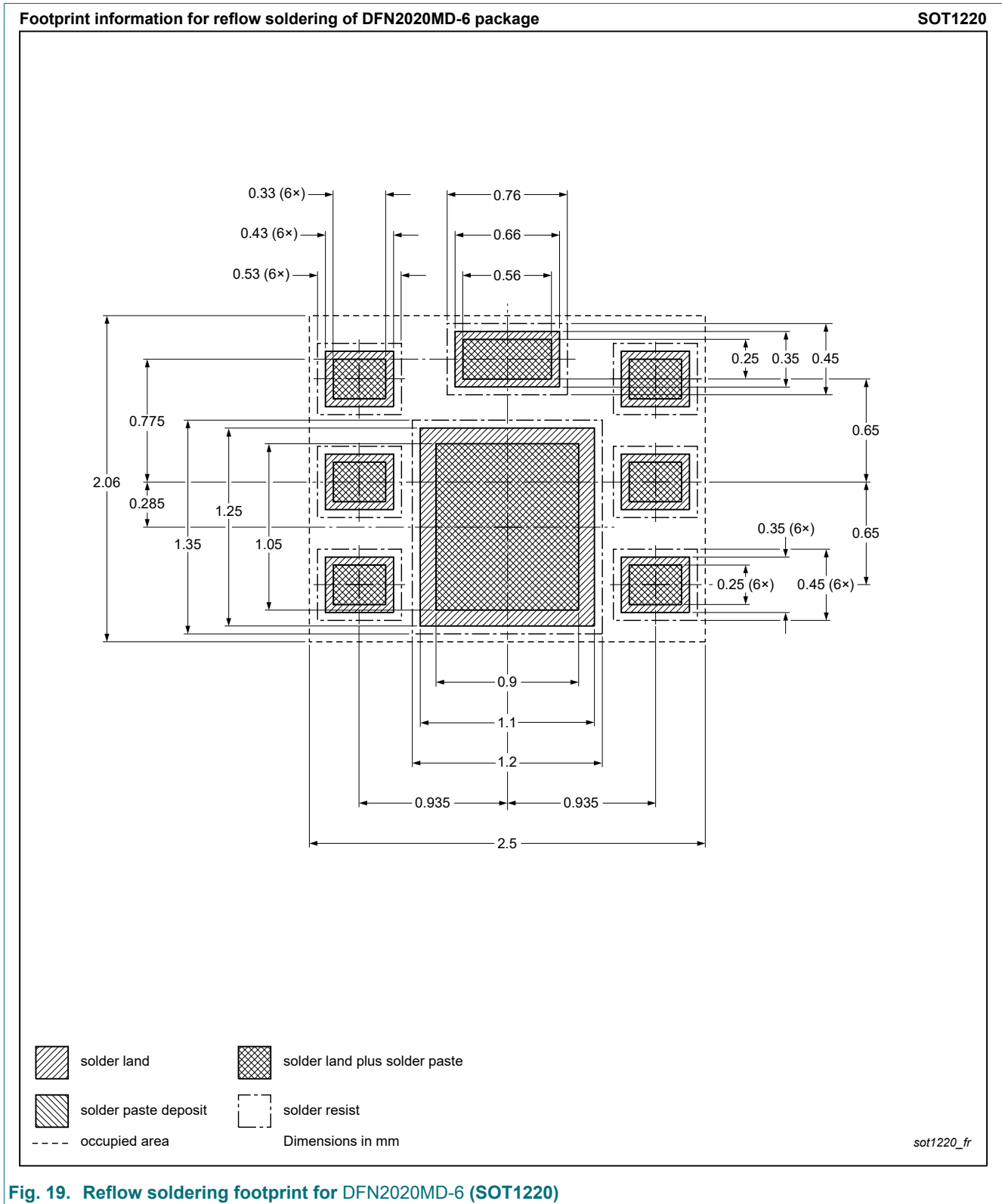


Fig. 19. Reflow soldering footprint for DFN2020MD-6 (SOT1220)

14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|-------------------|--------------------|---------------|----------------|
| BUK4D72-30 v.2 | 20230327 | Product data sheet | - | BUK4D72-30 v.1 |
| Modifications: | • Complete rework | | | |
| BUK4D72-30 v.1 | 20200708 | Product data sheet | - | - |

15. 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. |

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