



BUK6Y33-60P

60 V, P-channel Trench MOSFET

21 January 2021

Product data sheet

1. General description

P-channel enhancement mode MOSFET in an LFPAK56 (Power SO8) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

This product has been designed and qualified to AEC-Q101 standard for use in high-performance automotive applications such as reverse battery protection.

2. Features and benefits

- High thermal power dissipation capability
- Suitable for thermally demanding environments due to 175 °C rating
- Trench MOSFET technology
- AEC-Q101 qualified

3. Applications

- Reverse battery protection
- Power management
- High-side load switch
- Motor drive

4. Quick reference data

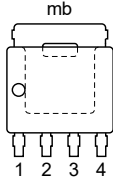
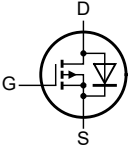
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------|----------------------------------|--|-----|-----|-----|------|
| V_{DS} | drain-source voltage | $T_j = 25\text{ °C}$ | - | - | -60 | V |
| V_{GS} | gate-source voltage | [1] | -20 | - | 20 | V |
| I_D | drain current | $V_{GS} = -10\text{ V}; T_{mb} = 25\text{ °C}$ | - | - | -30 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$ | - | - | 110 | W |
| Static characteristics | | | | | | |
| R_{DSon} | drain-source on-state resistance | $V_{GS} = -10\text{ V}; I_D = -7\text{ A}; T_j = 25\text{ °C}$ | - | 26 | 33 | mΩ |

[1] $V_{GS} = -20\text{ V}/+5\text{ V}$ according AEC-Q101 at $T_j = 175\text{ °C}$; $V_{GS} = -20\text{ V}/+20\text{ V}$ according AEC-Q101 at $T_j = 150\text{ °C}$

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-----------------------------------|---|--|
| 1 | S | source |  <p>LFPAK56; Power-SO8 (SOT669)</p> |  <p>017aaa094</p> |
| 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 |
| BUK6Y33-60P | LFPAK56; Power-SO8 | plastic, single-ended surface-mounted package; 4 terminals | SOT669 |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| BUK6Y33-60P | 6Y3360P |

8. Limiting values

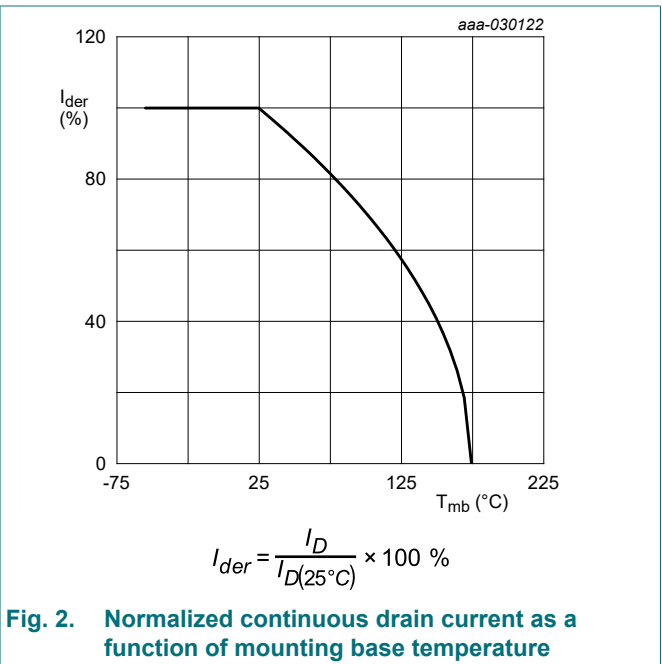
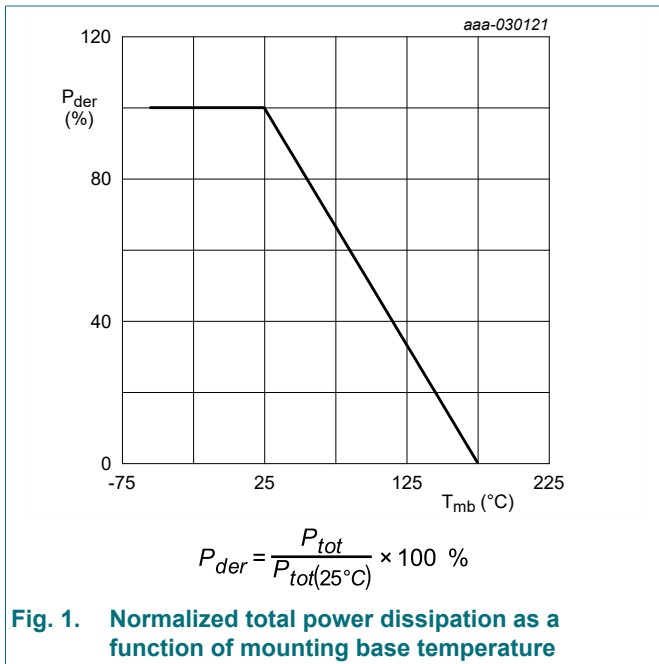
Table 5. Limiting values

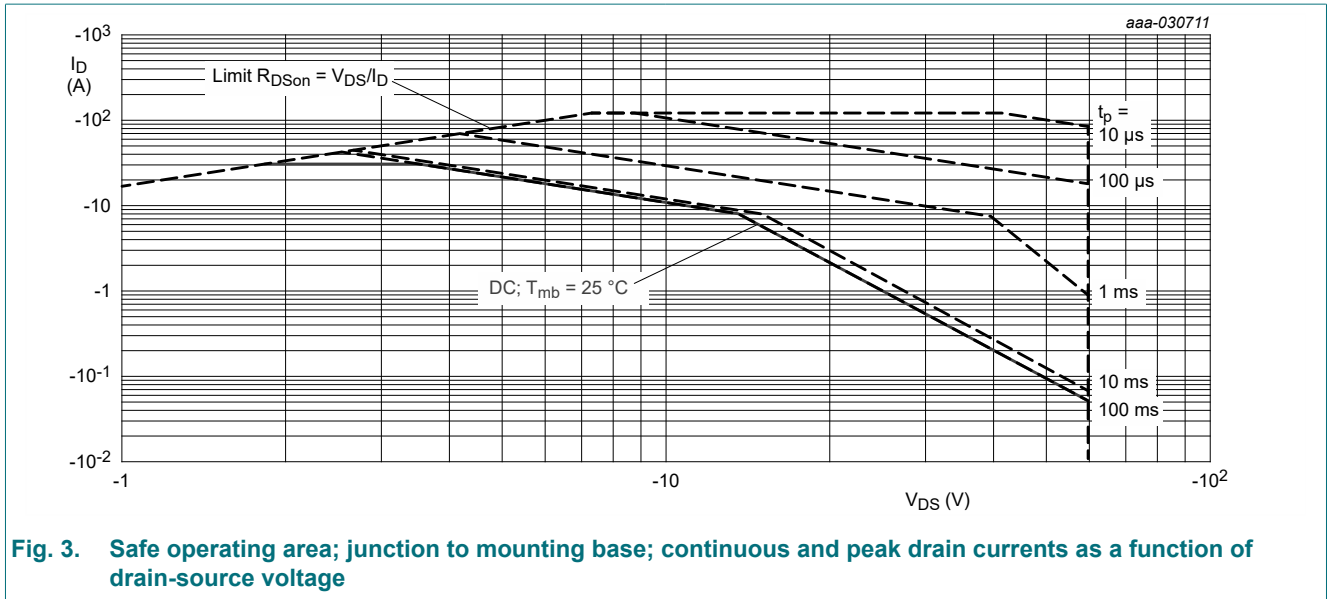
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|-----------------------------|--|--|-----|-----|------|------|
| V _{DS} | drain-source voltage | T _j = 25 °C | | - | -60 | V |
| V _{GS} | gate-source voltage | | [1] | -20 | 20 | V |
| I _D | drain current | V _{GS} = -10 V; T _{mb} = 25 °C | | - | -30 | A |
| | | V _{GS} = -10 V; T _{mb} = 100 °C | | - | -21 | A |
| I _{DM} | peak drain current | single pulse; t _p ≤ 10 μs; T _{mb} = 25 °C | | - | -120 | A |
| P _{tot} | total power dissipation | T _{mb} = 25 °C | | - | 110 | W |
| T _j | junction temperature | | | -55 | 175 | °C |
| T _{amb} | ambient temperature | | | -55 | 175 | °C |
| T _{stg} | storage temperature | | | -65 | 175 | °C |
| Source-drain diode | | | | | | |
| I _S | source current | T _{mb} = 25 °C | | - | -30 | A |
| I _{SM} | peak source current | single pulse; t _p ≤ 10 μs; T _{mb} = 25 °C | | - | -120 | A |
| ESD maximum rating | | | | | | |
| V _{ESD} | electrostatic discharge voltage | HBM | [2] | - | 1000 | V |
| Avalanche ruggedness | | | | | | |
| E _{DS(AL)S} | non-repetitive drain-source avalanche energy | T _{j(initial)} = 25 °C; I _D = -2.8 A; DUT in avalanche (unclamped) | | - | 85 | mJ |

[1] V_{GS} = -20 V/+5 V according AEC-Q101 at T_j = 175 °C; V_{GS} = -20 V/+20 V according AEC-Q101 at T_j = 150 °C

[2] Measured between all pins.

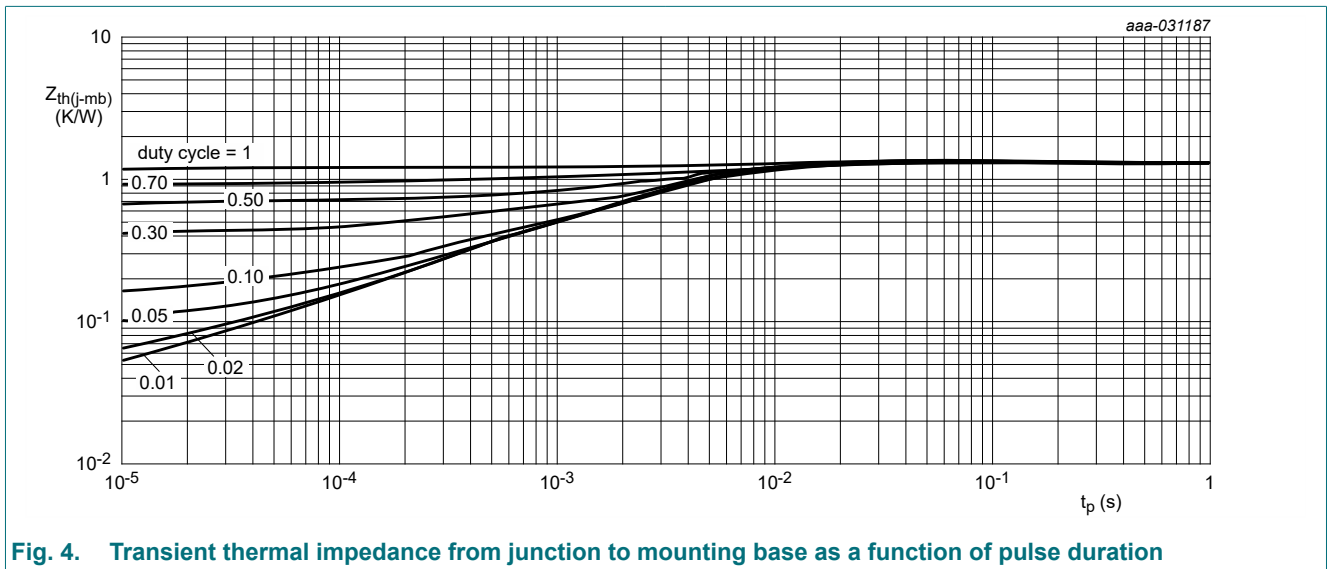




9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|---|------------|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | | - | 1.1 | 1.4 | K/W |



10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|---|------|------|------|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = -250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | -60 | - | - | V |
| V_{GSth} | gate-source threshold voltage | $I_D = -250 \mu\text{A}; V_{DS}=V_{GS}; T_j = 25 \text{ }^\circ\text{C}$ | -1.5 | -2 | -3 | V |
| I_{DSS} | drain leakage current | $V_{DS} = -60 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | - | -1 | μA |
| | | $V_{DS} = -60 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ\text{C}$ | - | - | -10 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | - | -100 | nA |
| | | $V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | - | 100 | nA |
| R_{DSon} | drain-source on-state resistance | $V_{GS} = -10 \text{ V}; I_D = -7 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ | - | 26 | 33 | m Ω |
| | | $V_{GS} = -10 \text{ V}; I_D = -7 \text{ A}; T_j = 175 \text{ }^\circ\text{C}$ | - | 55 | 69 | m Ω |
| | | $V_{GS} = -4.5 \text{ V}; I_D = -6.7 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ | - | 30 | 36 | m Ω |
| g_{fs} | forward transconductance | $V_{DS} = -10 \text{ V}; I_D = -4.8 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ | - | 99 | - | S |
| R_G | gate resistance | $f = 1 \text{ MHz}$ | - | 6.1 | - | Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $V_{DS} = -30 \text{ V}; I_D = -7 \text{ A}; V_{GS} = -10 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 46 | 69 | nC |
| Q_{GS} | gate-source charge | | - | 7.3 | - | nC |
| Q_{GD} | gate-drain charge | | - | 9.4 | - | nC |
| C_{iss} | input capacitance | $V_{DS} = -30 \text{ V}; f = 1 \text{ MHz}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 2590 | - | pF |
| C_{oss} | output capacitance | | - | 202 | - | pF |
| C_{rss} | reverse transfer capacitance | | - | 118 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = -30 \text{ V}; I_D = -7 \text{ A}; V_{GS} = -10 \text{ V}; R_{G(ext)} = 6 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$ | - | 9 | - | ns |
| t_r | rise time | | - | 16 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 81 | - | ns |
| t_f | fall time | | - | 310 | - | ns |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = -30 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | -0.7 | -1.2 | V |
| t_{rr} | reverse recovery time | $I_S = -30 \text{ A}; di_S/dt = 100 \text{ A}/\mu\text{s}; V_{GS} = -10 \text{ V}; V_{DS} = -30 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 32 | - | ns |
| Q_r | recovered charge | | - | 18 | - | nC |

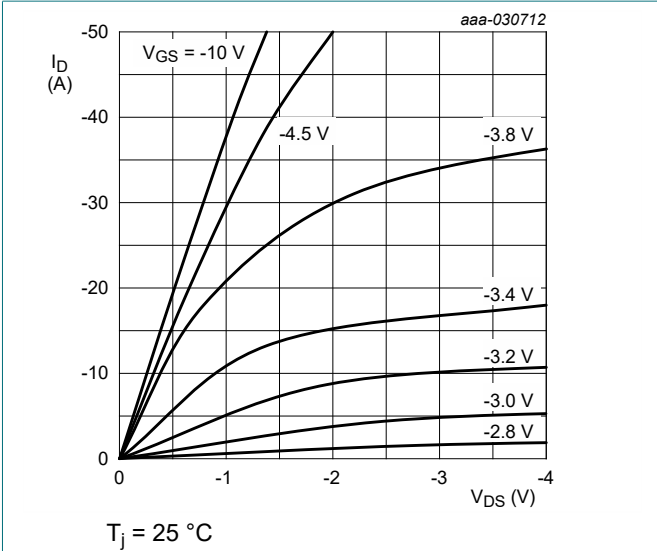


Fig. 5. Output characteristics: drain current as a function of drain-source voltage; typical values

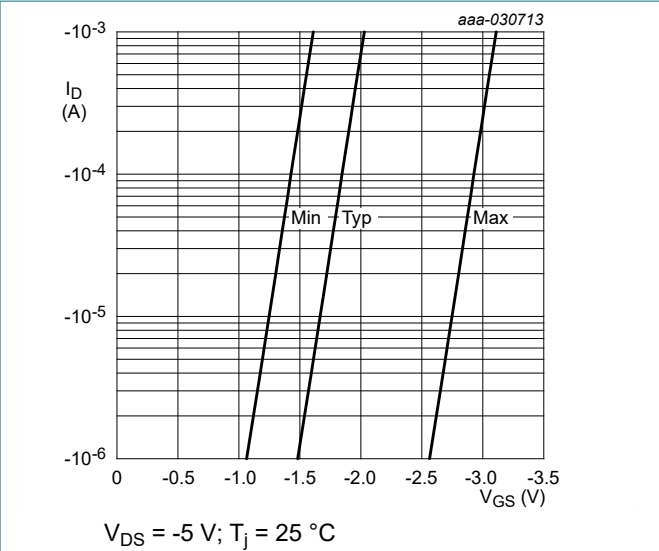


Fig. 6. Sub-threshold drain current as a function of gate-source voltage

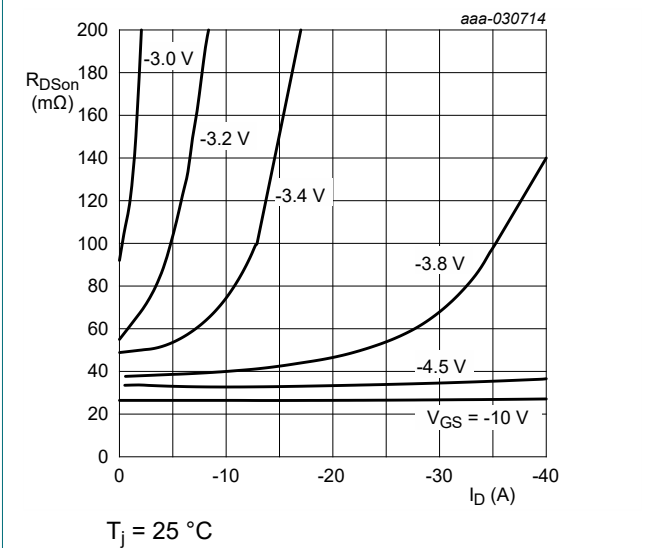


Fig. 7. Drain-source on-state resistance as a function of drain current; typical values

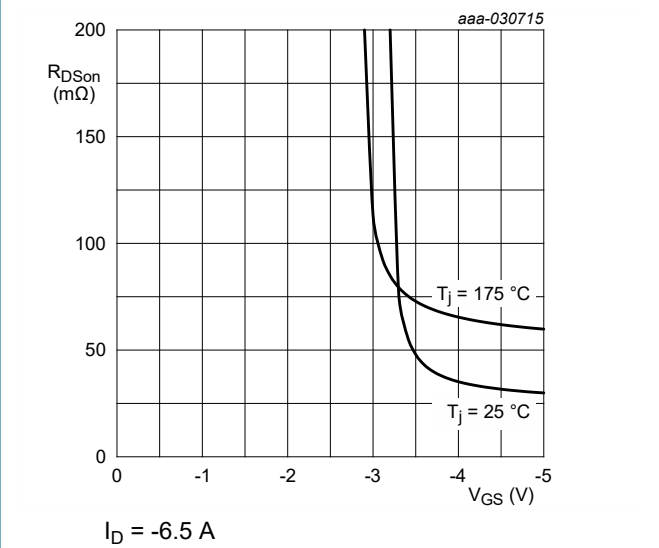


Fig. 8. Drain-source on-state resistance as a function of gate-source voltage; typical values

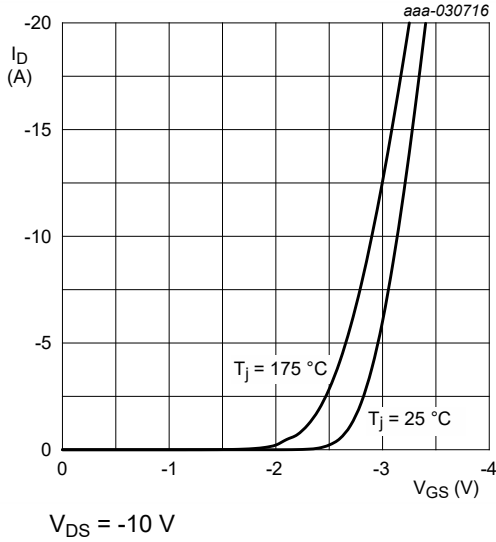


Fig. 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values

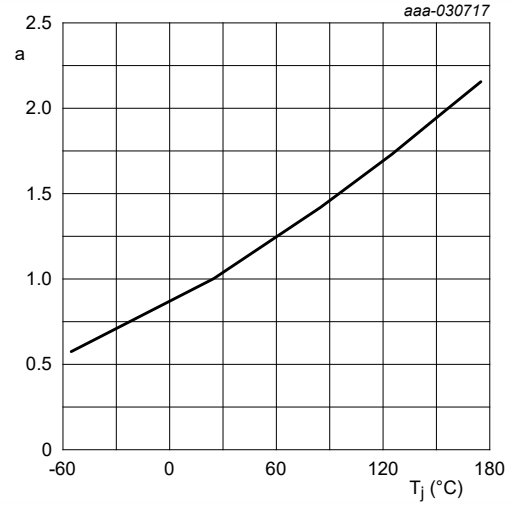


Fig. 10. Normalized drain-source on-state resistance as a function of junction temperature; typical values

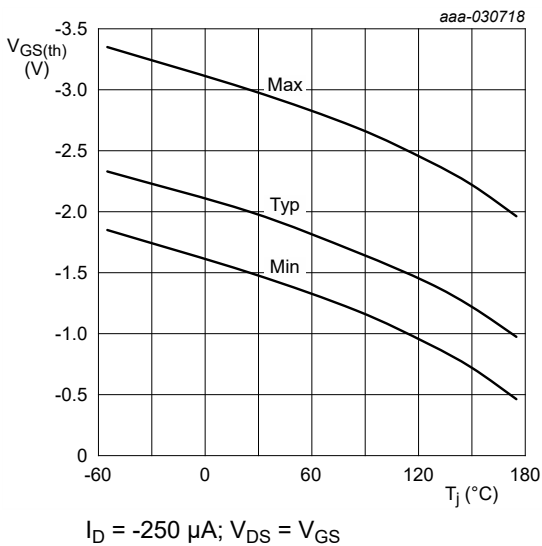


Fig. 11. Gate-source threshold voltage as a function of junction temperature

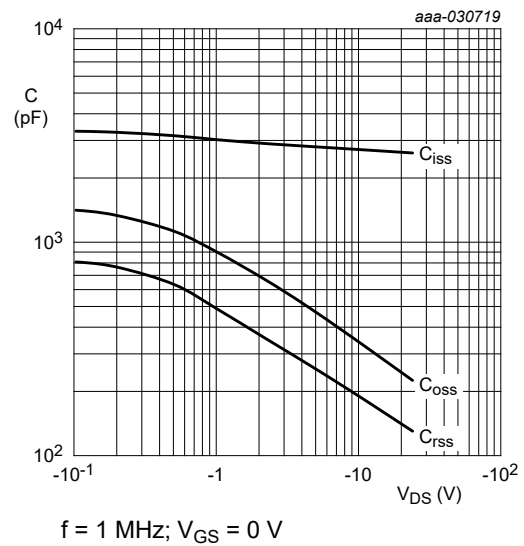
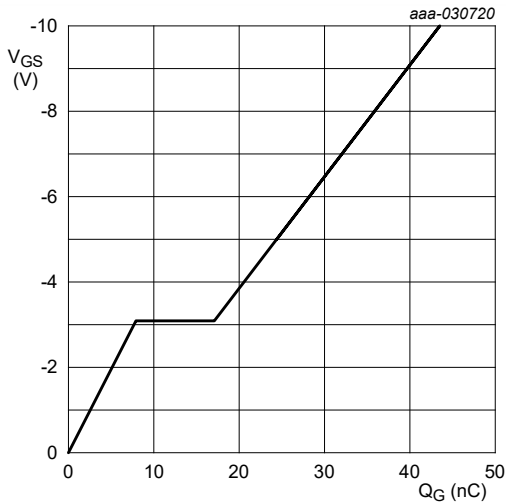


Fig. 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$V_{DS} = -30\text{ V}$; $I_D = -10.8\text{ A}$; $T_j = 25\text{ }^\circ\text{C}$

Fig. 13. Gate-source voltage as a function of gate charge; typical values

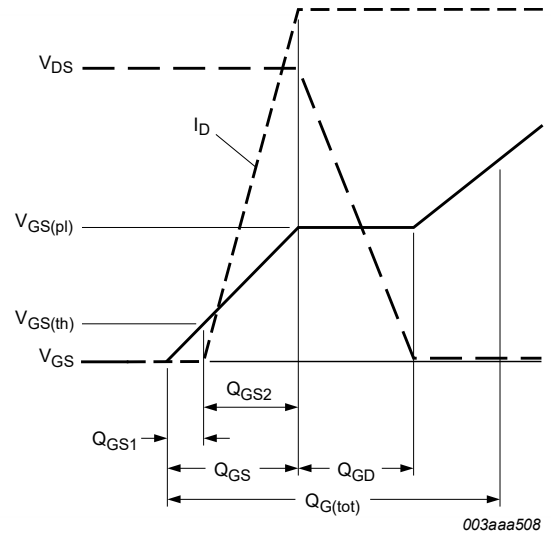
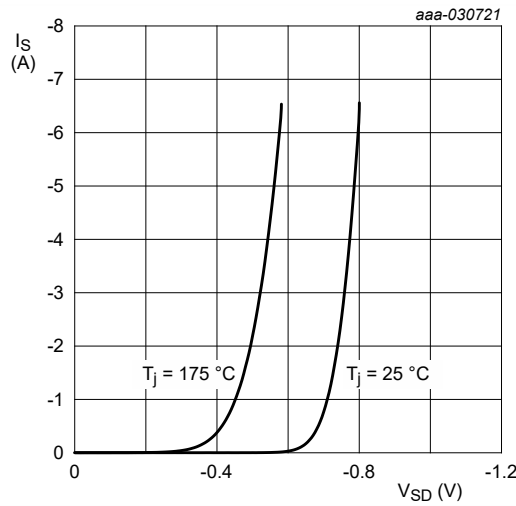


Fig. 14. Gate charge waveform definitions



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

Fig. 15. Source current as a function of source-drain voltage; typical values

11. Test information

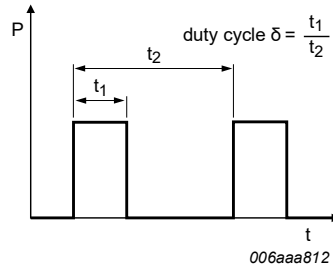


Fig. 16. Duty cycle definition

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

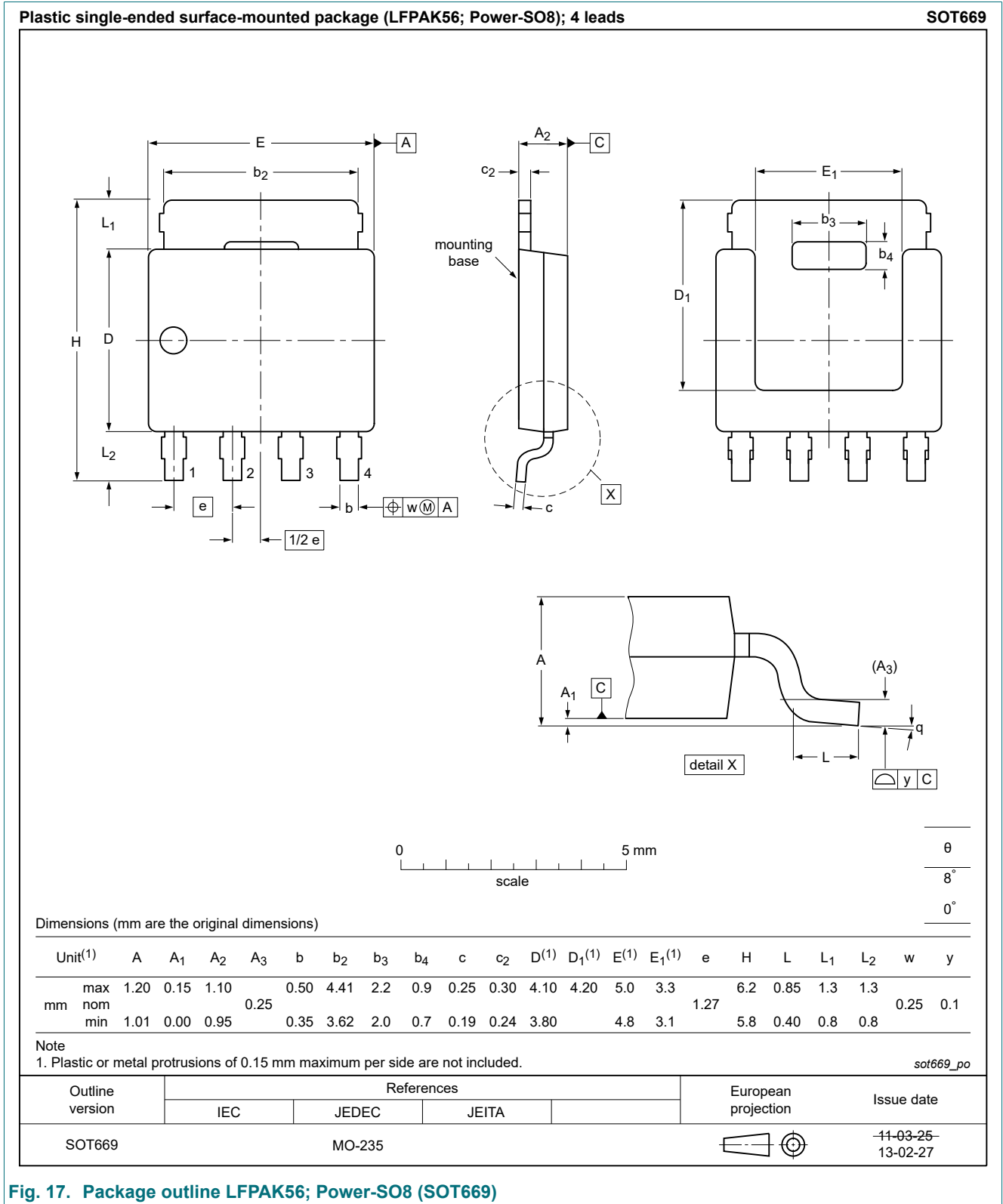


Fig. 17. Package outline LFAK56; Power-SO8 (SOT669)

13. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|-----------------|--|--------------------|---------------|-----------------|
| BUK6Y33-60P v.3 | 20210121 | Product data sheet | - | BUK6Y33-60P v.2 |
| Modifications: | <ul style="list-style-type: none">Chapter "Characteristics": Typo correction at parameter t_f. Correction of the conditions for the source-drain diode parameters V_{SD}, t_{rr}, Q_r. | | | |
| BUK6Y33-60P v.2 | 20200318 | Product data sheet | - | BUK6Y33-60P v.1 |
| BUK6Y33-60P v.1 | 20200316 | Product data sheet | - | - |

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. |

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Date of release: 21 January 2021

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