

BUK7K52-60E

Dual N-channel 60 V, 45 mΩ standard level MOSFET

10 December 2013

Product data sheet

1. General description

Dual standard level N-channel MOSFET in an LFPAK56D (Dual Power-SO8) package using TrenchMOS technology. This product has been designed and qualified to AEC Q101 standard for use in high performance automotive applications.

2. Features and benefits

- Dual MOSFET
- Q101 compliant
- Repetitive avalanche rated
- Suitable for thermally demanding environments due to 175 °C rating
- True standard level gate with $V_{GS(th)}$ of greater than 1 V at 175 °C

3. Applications

- 12 V Automotive systems
- Motors, lamps and solenoid control
- Transmission 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 | $T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$ | - | - | 60 | V |
| I_D | drain current | $V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C}; \text{Fig. 1}$ | - | - | 15.4 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}; \text{Fig. 2}$ | - | - | 32 | W |
| Static characteristics FET1 and FET2 | | | | | | |
| R_{DSon} | drain-source on-state resistance | $V_{GS} = 10\text{ V}; I_D = 5\text{ A}; T_j = 25\text{ °C}; \text{Fig. 11}$ | - | 35 | 45 | mΩ |
| Dynamic characteristics FET1 and FET2 | | | | | | |
| Q_{GD} | gate-drain charge | $I_D = 5\text{ A}; V_{DS} = 48\text{ V}; V_{GS} = 10\text{ V}; T_j = 25\text{ °C}; \text{Fig. 13}; \text{Fig. 14}$ | - | 3.5 | - | nC |

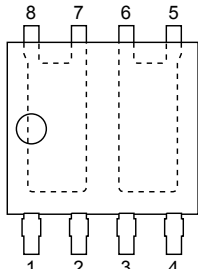
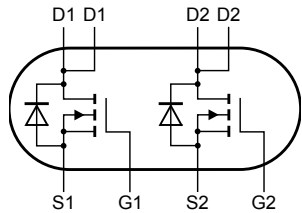


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5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------|--|--|
| 1 | S1 | source1 |  <p>LFPAK56D (SOT1205)</p> |  <p><i>mbk725</i></p> |
| 2 | G1 | gate1 | | |
| 3 | S2 | source2 | | |
| 4 | G2 | gate2 | | |
| 5 | D2 | drain2 | | |
| 6 | D2 | drain2 | | |
| 7 | D1 | drain1 | | |
| 8 | D1 | drain1 | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|----------|--|---------|
| | Name | Description | Version |
| BUK7K52-60E | LFPAK56D | Plastic single ended surface mounted package (LFPAK56D); 8 leads | SOT1205 |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| BUK7K52-60E | 75260E |

8. Limiting values

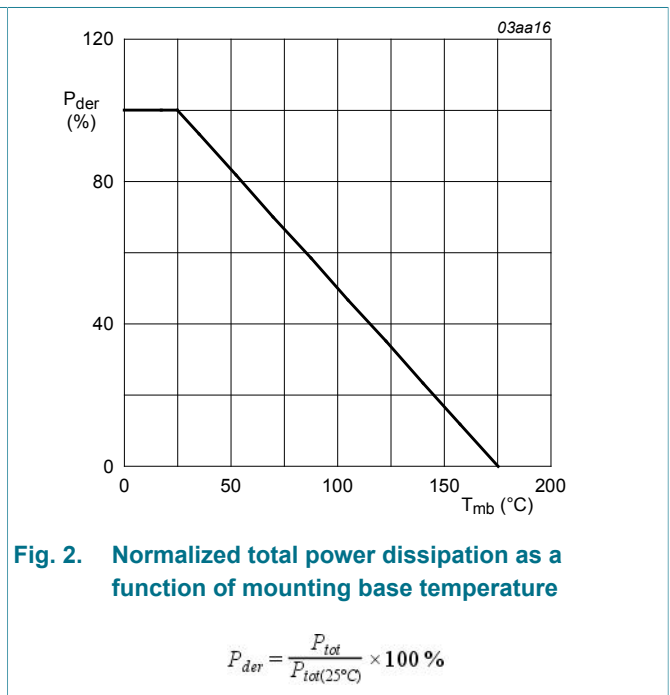
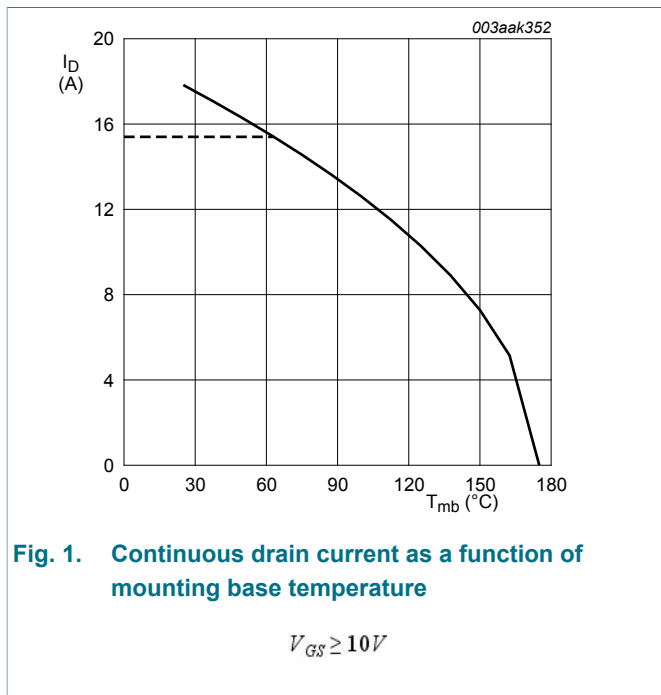
Table 5. Limiting values

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

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|-------------------------|---|-----|------|------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$ | - | 60 | V |
| V_{DGR} | drain-gate voltage | $R_{GS} = 20\text{ k}\Omega$ | - | 60 | V |
| V_{GS} | gate-source voltage | $T_j \leq 175\text{ °C}$; DC | -20 | 20 | V |
| I_D | drain current | $T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; Fig. 1 | - | 15.4 | A |
| | | $T_{mb} = 100\text{ °C}$; $V_{GS} = 10\text{ V}$; Fig. 1 | - | 12.6 | A |
| I_{DM} | peak drain current | $T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$; Fig. 4 | - | 71 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; Fig. 2 | - | 32 | W |

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|--|---|---|------|---------|
| T _{stg} | storage temperature | | -55 | 175 | °C |
| T _j | junction temperature | | -55 | 175 | °C |
| Source-drain diode FET1 and FET2 | | | | | |
| I _S | source current | T _{mb} = 25 °C | - | 15.4 | A |
| I _{SM} | peak source current | pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C | - | 71 | A |
| Avalanche Ruggedness FET1 and FET2 | | | | | |
| E _{DS(AL)S} | non-repetitive drain-source avalanche energy | I _D = 15.4 A; V _{sup} ≤ 60 V; V _{GS} = 10 V; T _{j(init)} = 25 °C; Fig. 3 | [1] [2] | - | 11.6 mJ |

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



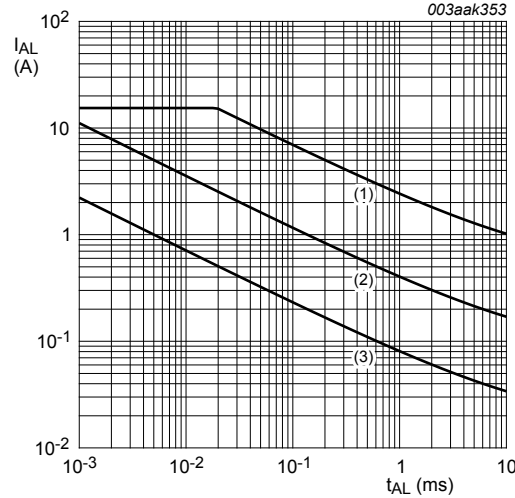


Fig. 3. Avalanche rating; avalanche current as a function of avalanche time

(1) $T_{j (int)} = 25^{\circ}C$; (2) $T_{j (int)} = 150^{\circ}C$; (3) Repetitive Avalanche

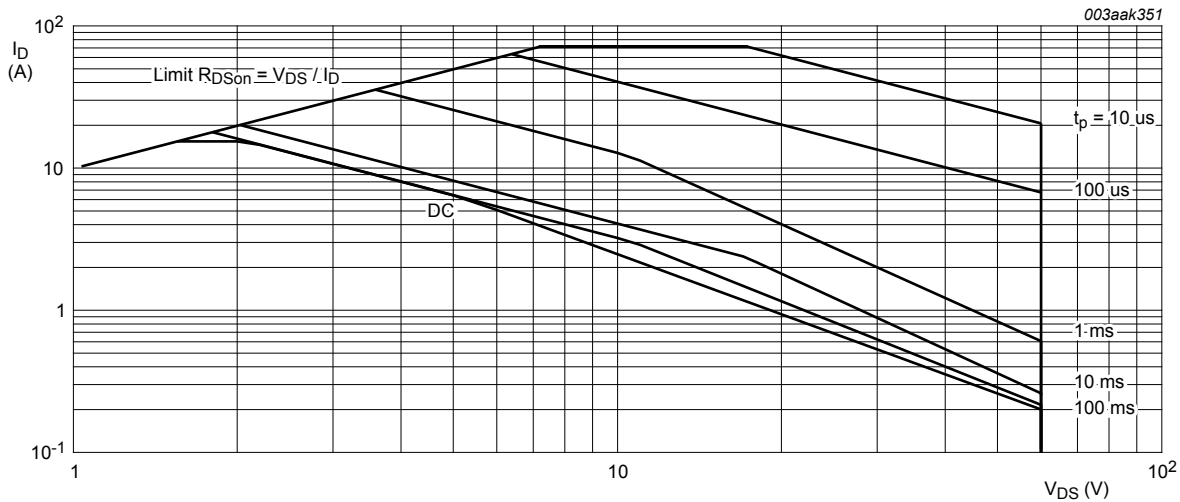


Fig. 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25^{\circ}C$; I_{DM} is a single pulse

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 | - | - | 4.68 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | Minimum footprint; mounted on a printed circuit board | - | 95 | - | K/W |

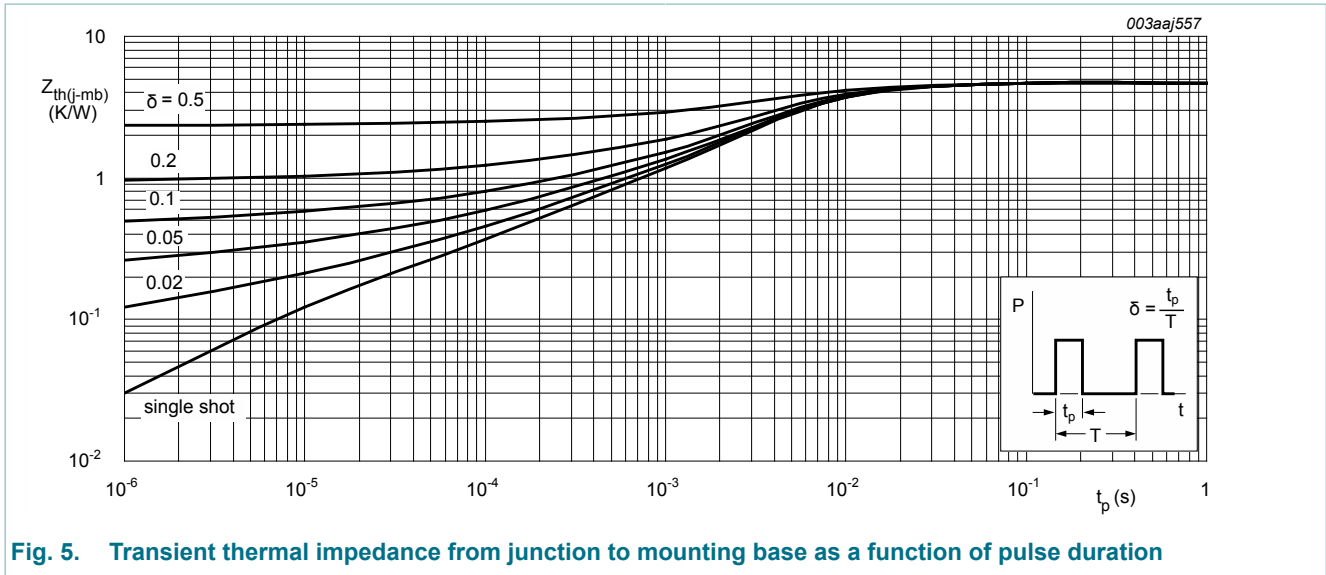


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|----------------------------------|---|-----|------|-----|---------|
| Static characteristics FET1 and FET2 | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$ | 54 | - | - | V |
| | | $I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$ | 60 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C;$ Fig. 9; Fig. 10 | 2.4 | 3 | 4 | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ C;$ Fig. 9; Fig. 10 | 1 | - | - | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C;$ Fig. 9; Fig. 10 | - | - | 4.5 | V |
| I_{DSS} | drain leakage current | $V_{DS} = 60 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$ | - | 0.02 | 1 | μA |
| | | $V_{DS} = 60 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ C$ | - | - | 500 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$ | - | 2 | 100 | nA |
| | | $V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$ | - | 2 | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10 \text{ V}; I_D = 5 \text{ A}; T_j = 25 \text{ }^\circ C;$ Fig. 11 | - | 35 | 45 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 5 \text{ A}; T_j = 175 \text{ }^\circ C;$ Fig. 12; Fig. 11 | - | 78 | 101 | mΩ |
| Dynamic characteristics FET1 and FET2 | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 5 \text{ A}; V_{DS} = 48 \text{ V}; V_{GS} = 10 \text{ V};$ $T_j = 25 \text{ }^\circ C;$ Fig. 13; Fig. 14 | - | 9.2 | - | nC |
| Q_{GS} | gate-source charge | | - | 2 | - | nC |
| Q_{GD} | gate-drain charge | | - | 3.5 | - | nC |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|------------------------------|--|-----|------|-----|------|
| $V_{GS(pl)}$ | gate-source plateau voltage | $I_D = 5\text{ A}$; $V_{DS} = 48\text{ V}$; $T_j = 25\text{ °C}$; Fig. 13 ; Fig. 14 | - | 5 | - | V |
| C_{iss} | input capacitance | $V_{GS} = 0\text{ V}$; $V_{DS} = 25\text{ V}$; $f = 1\text{ MHz}$; $T_j = 25\text{ °C}$; Fig. 15 | - | 401 | 535 | pF |
| C_{oss} | output capacitance | | - | 73 | 87 | pF |
| C_{rss} | reverse transfer capacitance | | - | 53 | 72 | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 48\text{ V}$; $R_L = 5\text{ }\Omega$; $V_{GS} = 10\text{ V}$; $R_{G(ext)} = 5\text{ }\Omega$; $T_j = 25\text{ °C}$; $I_D = 5\text{ A}$ | - | 4.3 | - | ns |
| t_r | rise time | | - | 5.1 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 8.4 | - | ns |
| t_f | fall time | | - | 5.4 | - | ns |
| Source-drain diode FET1 and FET2 | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 5\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ °C}$; Fig. 16 | - | 0.83 | 1.2 | V |
| t_{rr} | reverse recovery time | $I_S = 5\text{ A}$; $di_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$; $V_{DS} = 30\text{ V}$; $T_j = 25\text{ °C}$ | - | 17.6 | - | ns |
| Q_r | recovered charge | | - | 12.3 | - | nC |

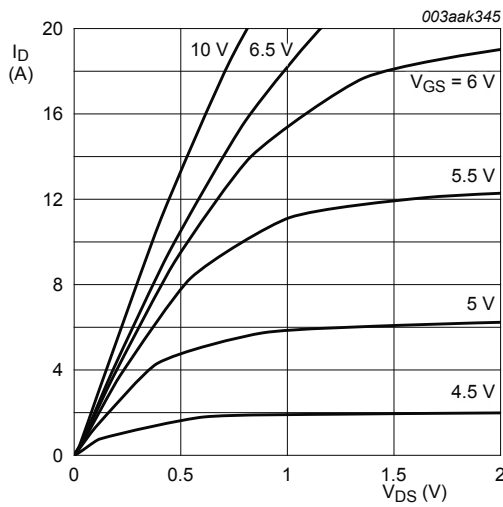


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

$T_j = 25\text{ °C}$

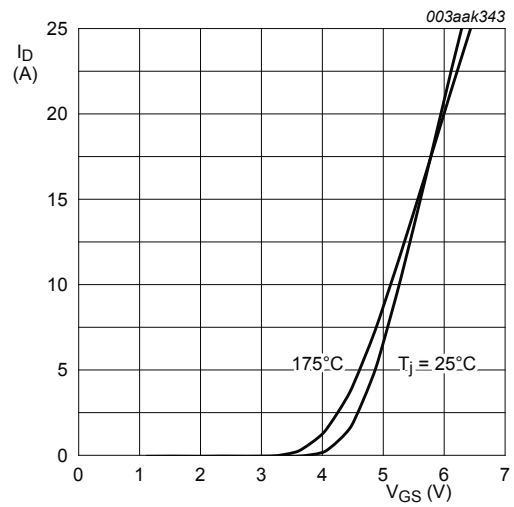


Fig. 7. Transfer characteristics; drain current as a function of gate-source voltage; typical values

$V_{DS} = 10\text{ V}$

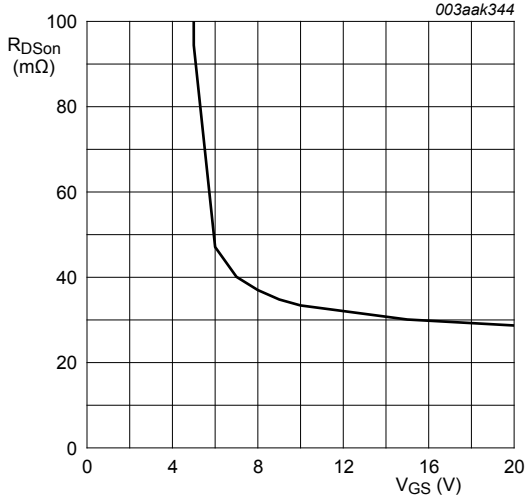


Fig. 8. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25^\circ\text{C}; I_D = 5\text{A}$

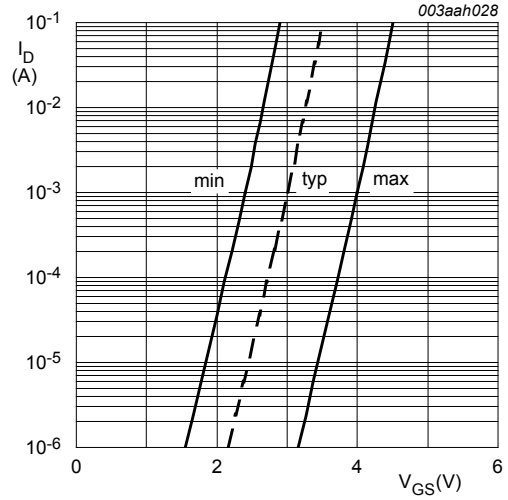


Fig. 9. Sub-threshold drain current as a function of gate-source voltage

$T_j = 25^\circ\text{C}; V_{DS} = 5\text{V}$

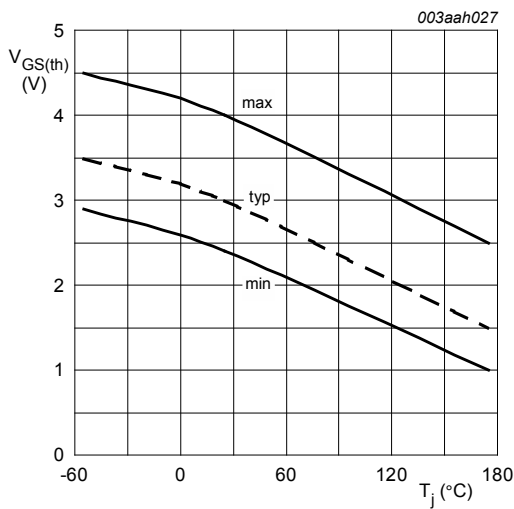


Fig. 10. Gate-source threshold voltage as a function of junction temperature

$I_D = 1\text{ mA}; V_{DS} = V_{GS}$

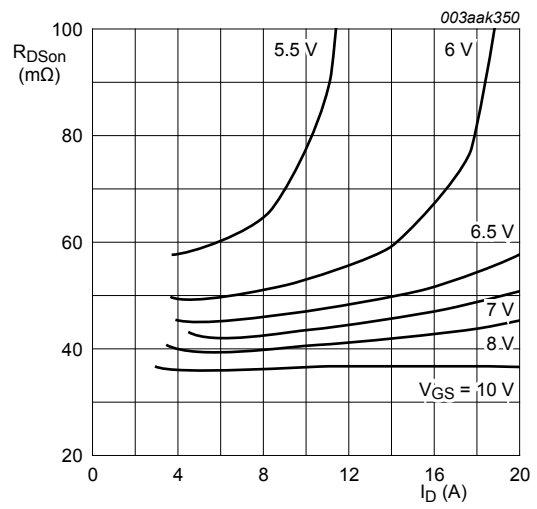


Fig. 11. Drain-source on-state resistance as a function of drain current; typical values

$T_j = 25^\circ\text{C}$

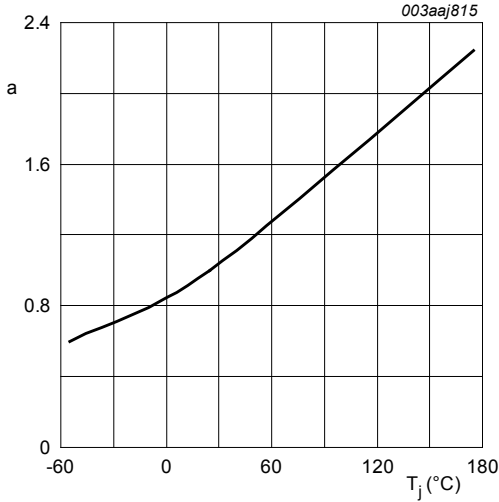


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

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

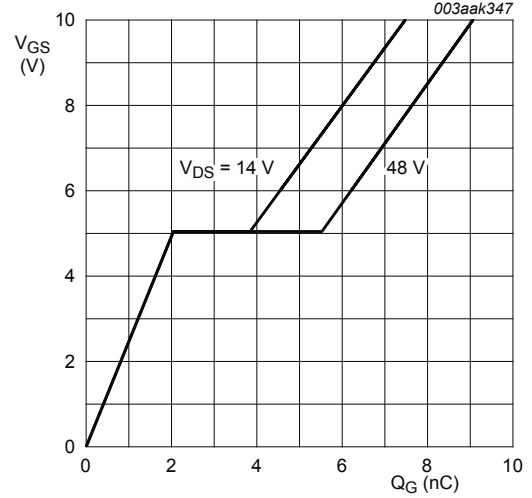


Fig. 13. Gate-source voltage as a function of gate charge; typical values

$T_j = 25^\circ\text{C}; I_D = 5\text{ A}$

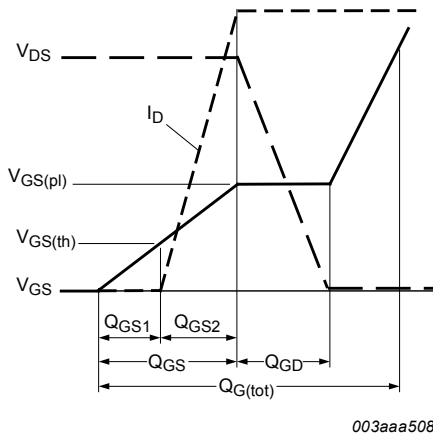


Fig. 14. Gate charge waveform definitions

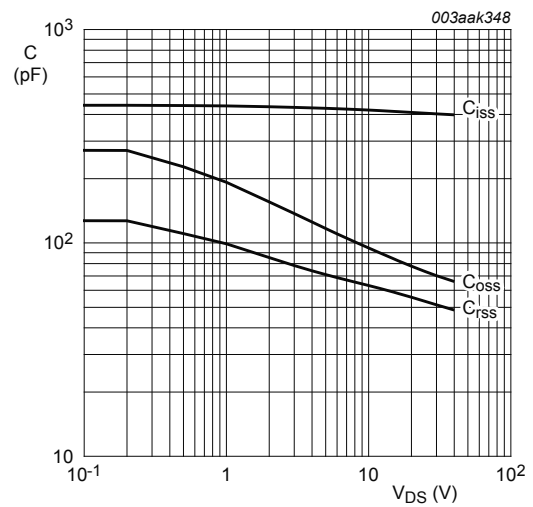


Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

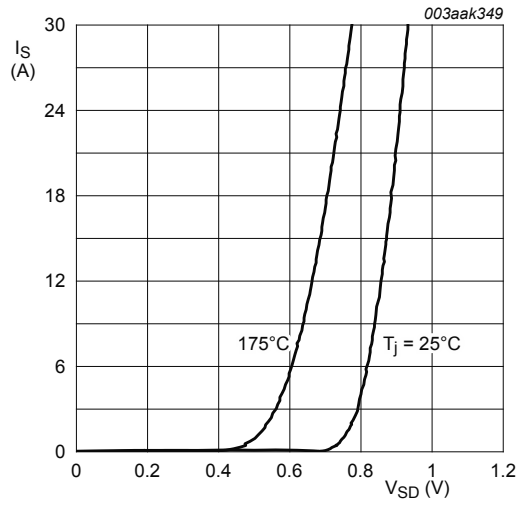
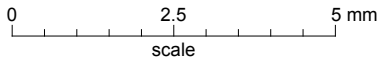
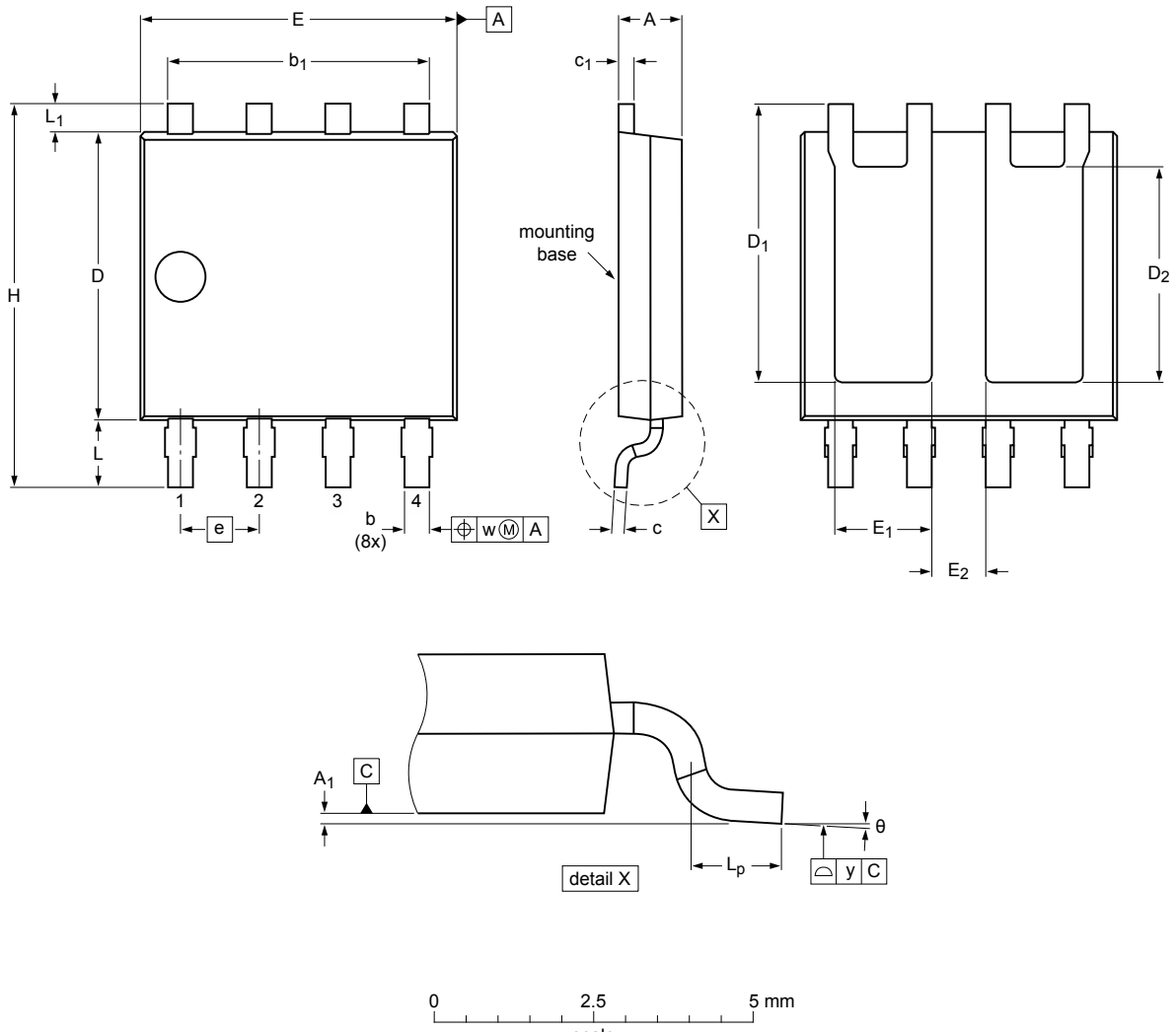


Fig. 16. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

11. Package outline

Plastic single ended surface mounted package (LPAK56D); 8 leads SOT1205



Dimensions

| Unit | A | A ₁ | b | b ₁ | c | c ₁ | D ⁽¹⁾ | D ₁ ⁽¹⁾ | D ₂ ^(ref) | E ⁽¹⁾ | E ₁ ⁽¹⁾ | E ₂ | e | H | L | L ₁ | L _p | w | y | θ | |
|------|------|----------------|------|----------------|------|----------------|------------------|-------------------------------|---------------------------------|------------------|-------------------------------|----------------|------|-----|------|----------------|----------------|------|-----|----|--|
| max | 1.05 | 0.1 | 0.50 | 4.4 | 0.25 | 0.30 | 4.70 | 4.8 | 3.5 | 5.30 | 1.8 | 0.85 | 6.2 | 1.3 | 0.55 | 0.85 | | 0.25 | 0.1 | 8° | |
| nom | | | | | | | | | | | | | 1.27 | | | | | | | | |
| min | | 0.0 | 0.35 | 4.1 | 0.19 | 0.24 | 4.45 | | | 4.95 | 1.6 | | 5.9 | 0.8 | 0.30 | 0.40 | | | | 0° | |

Note

1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

sot1205_po

| Outline version | References | | | | European projection | Issue date |
|-----------------|------------|-------|-------|--|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | | |
| SOT1205 | | | | | | 13-02-19 13-02-21 |

Fig. 17. Package outline LPAK56D (SOT1205)

12. Legal information

12.1 Data sheet status

| Document status [1][2] | Product status [3] | Definition |
|--------------------------------|--------------------|---|
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