



BUK965R8-100E

N-channel TrenchMOS logic level FET

Rev. 2 — 16 May 2012

Product data sheet

1. Product profile

1.1 General description

Logic level N-channel MOSFET in a SOT404 package using TrenchMOS technology. This product has been designed and qualified to AEC Q101 standard for use in high performance automotive applications.

1.2 Features and benefits

- AEC Q101 compliant
- Repetitive avalanche rated
- Suitable for thermally demanding environments due to 175 °C rating
- True logic level gate with $V_{gst(th)}$ rating of greater than 0.5V at 175 °C

1.3 Applications

- 12V, 24V and 48V Automotive systems
- Motors, lamps and solenoid control
- Start-Stop micro-hybrid applications
- Transmission control
- Ultra high performance power switching

1.4 Quick reference data

Table 1. Quick reference data

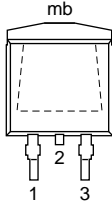
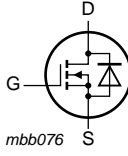
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|--|-----|------|-----|------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$ | - | - | 100 | V |
| I_D | drain current | $V_{GS} = 5\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 1 | [1] | - | 120 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; see Figure 2 | - | - | 357 | W |
| Static characteristics | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 5\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; see Figure 11 | - | 4.62 | 5.8 | mΩ |
| Dynamic characteristics | | | | | | |
| Q_{GD} | gate-drain charge | $V_{GS} = 5\text{ V}$; $I_D = 25\text{ A}$; $V_{DS} = 80\text{ V}$; see Figure 13 ; see Figure 14 | - | 51 | - | nC |

[1] Continuous current is limited by package.



2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|--------------------------------------|---|---|
| 1 | G | gate |  |  |
| 2 | D | drain | | |
| 3 | S | source | | |
| mb | D | mounting base; connected to drain | | |

SOT404 (D2PAK)

3. Ordering information

Table 3. Ordering information

| Type number | Package | | Version |
|---------------|---------|---|---------|
| | Name | Description | |
| BUK965R8-100E | D2PAK | plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped) | SOT404 |

4. Marking

Table 4. Marking codes

| Type number | Marking code |
|---------------|---------------|
| BUK965R8-100E | BUK965R8-100E |

5. Limiting values

Table 5. Limiting values

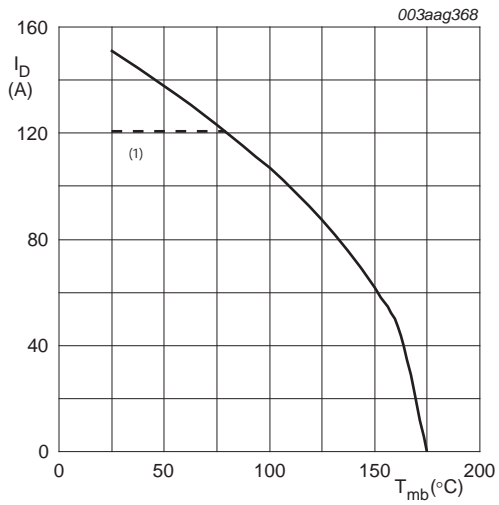
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------------------------|--|---|--------|-----|------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$ | - | 100 | V |
| V_{DGR} | drain-gate voltage | $R_{GS} = 20\text{ k}\Omega$ | - | 100 | V |
| V_{GS} | gate-source voltage | DC | -10 | 10 | V |
| | | Pulsed | -15 | 15 | V |
| I_D | drain current | $T_{mb} = 25\text{ °C}$; $V_{GS} = 5\text{ V}$; see Figure 1 | [1] | 120 | A |
| | | $T_{mb} = 100\text{ °C}$; $V_{GS} = 5\text{ V}$; see Figure 1 | - | 105 | A |
| I_{DM} | peak drain current | $T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$; see Figure 4 | - | 597 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; see Figure 2 | - | 357 | W |
| T_{stg} | storage temperature | | -55 | 175 | °C |
| T_j | junction temperature | | -55 | 175 | °C |
| Source-drain diode | | | | | |
| I_S | source current | $T_{mb} = 25\text{ °C}$ | [1] | 120 | A |
| I_{SM} | peak source current | pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$ | - | 597 | A |
| Avalanche ruggedness | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 120\text{ A}$; $V_{sup} \leq 100\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 5\text{ V}$; $T_{j(init)} = 25\text{ °C}$; unclamped; see Figure 3 | [2][3] | 385 | mJ |

[1] Continuous current is limited by package.

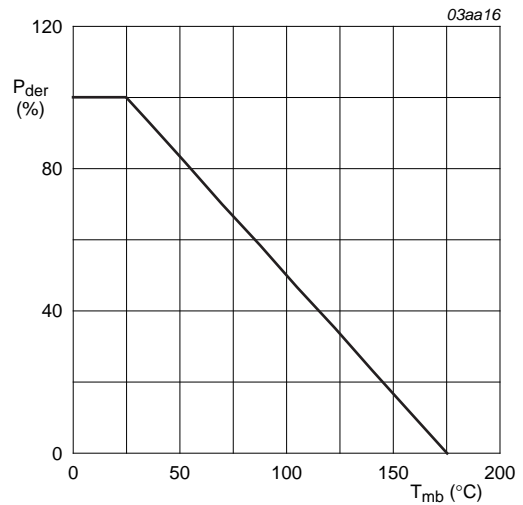
[2] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.

[3] Refer to application note AN10273 for further information.



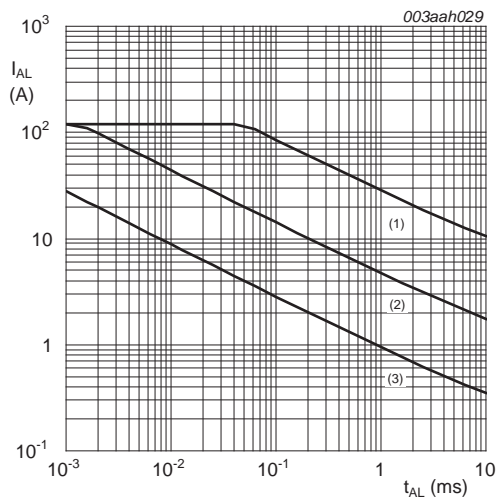
$V_{GS} \geq 5V$
 (1) Capped at 120 A due to package.

Fig 1. Continuous drain current as a function of mounting base temperature



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

Fig 2. Normalized total power dissipation as a function of mounting base temperature



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

Fig 3. Single-pulse and repetitive avalanche rating; avalanche current as a function of avalanche time

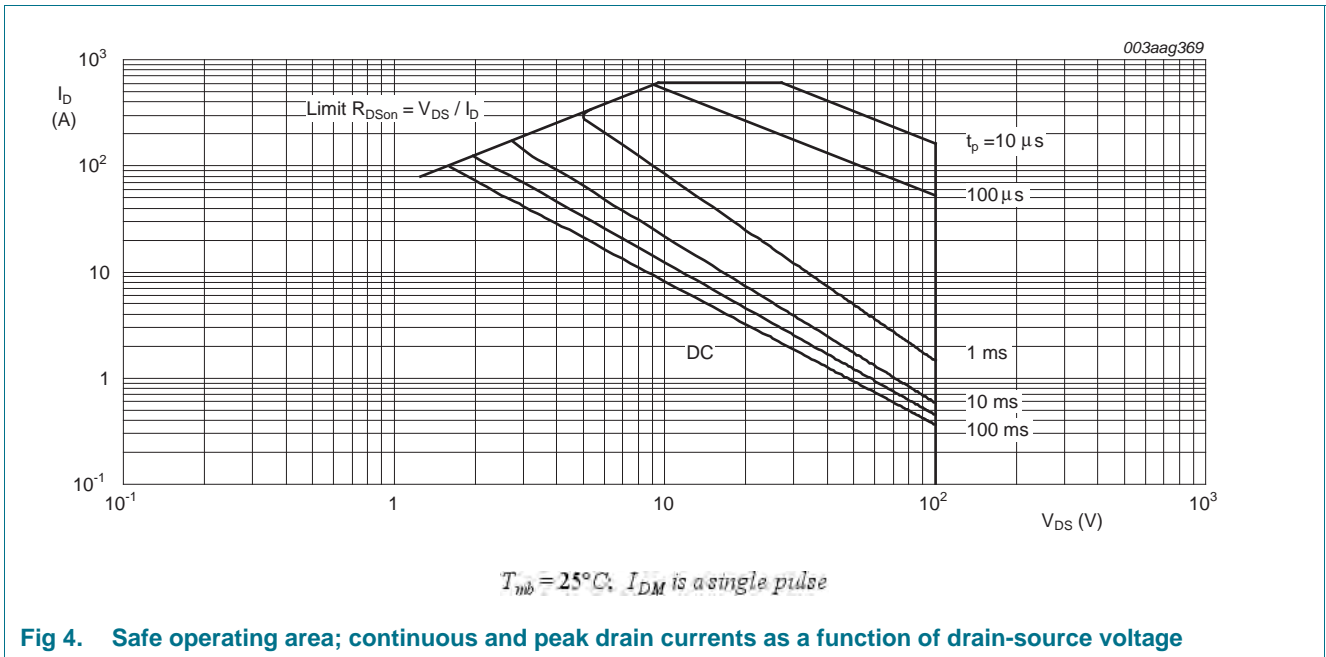


Fig 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

6. Thermal characteristics

Table 6. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|---|---|-----|-----|------|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | see Figure 5 | - | - | 0.42 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | minimum footprint; mounted on a printed-circuit board | - | 50 | - | K/W |

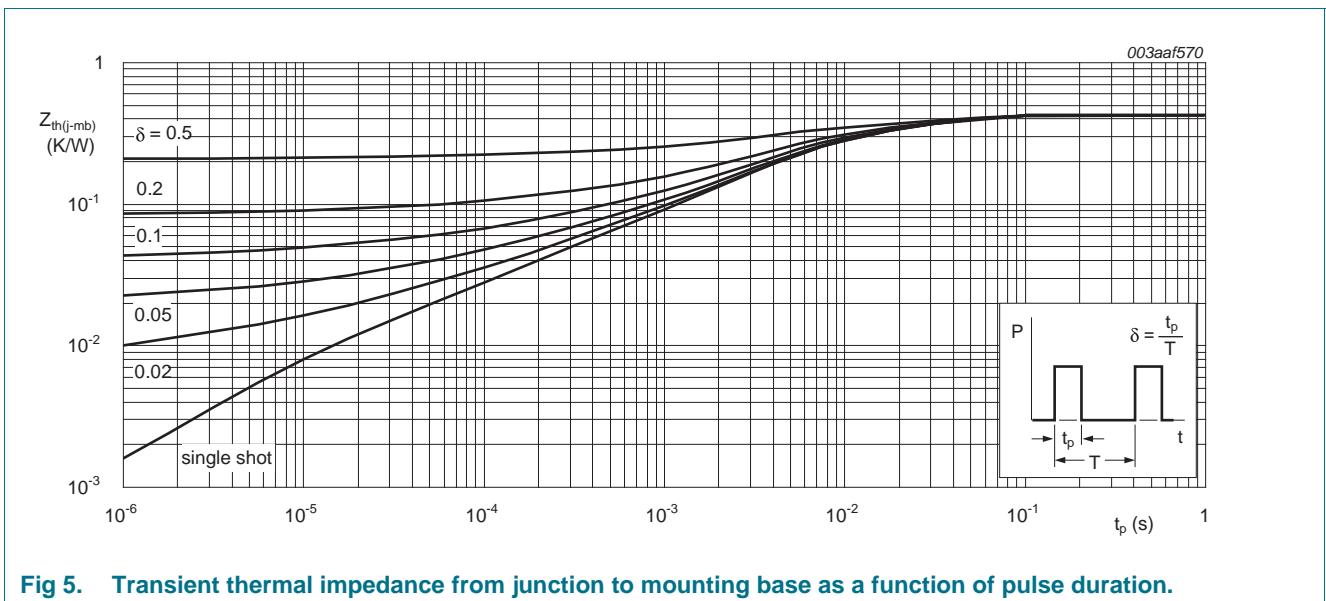


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration.

7. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|---|-----|-------|-------|------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$ | 100 | - | - | V |
| | | $I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$ | 90 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C$; see Figure 9 ; see Figure 10 | 1.4 | 1.7 | 2.1 | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C$; see Figure 9 | - | - | 2.45 | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ C$; see Figure 9 | 0.5 | - | - | V |
| I_{DSS} | drain leakage current | $V_{DS} = 100 V; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$ | - | 0.05 | 1 | μA |
| | | $V_{DS} = 100 V; V_{GS} = 0 V; T_j = 175 \text{ }^\circ C$ | - | - | 500 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 10 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$ | - | 2 | 100 | nA |
| | | $V_{GS} = -10 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$ | - | 2 | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 5 V; I_D = 25 A; T_j = 25 \text{ }^\circ C$; see Figure 11 | - | 4.62 | 5.8 | m Ω |
| | | $V_{GS} = 10 V; I_D = 25 A; T_j = 25 \text{ }^\circ C$; see Figure 11 | - | 4.45 | 5.6 | m Ω |
| | | $V_{GS} = 5 V; I_D = 25 A; T_j = 175 \text{ }^\circ C$; see Figure 12 ; see Figure 11 | - | - | 16 | m Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 25 A; V_{DS} = 80 V; V_{GS} = 5 V$; see Figure 13 ; see Figure 14 | - | 133 | - | nC |
| Q_{GS} | gate-source charge | | - | 23 | - | nC |
| Q_{GD} | gate-drain charge | | - | 51 | - | nC |
| C_{iss} | input capacitance | $V_{GS} = 0 V; V_{DS} = 25 V; f = 1 \text{ MHz}$; $T_j = 25 \text{ }^\circ C$; see Figure 15 | - | 13100 | 17460 | pF |
| C_{oss} | output capacitance | | - | 725 | 870 | pF |
| C_{rss} | reverse transfer capacitance | | - | 450 | 620 | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 80 V; R_L = 3.2 \Omega; V_{GS} = 5 V$; $R_{G(ext)} = 5 \Omega$ | - | 81 | - | ns |
| t_r | rise time | | - | 168 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 237 | - | ns |
| t_f | fall time | | - | 148 | - | ns |
| L_D | internal drain inductance | from upper edge of drain mounting base to center of die | - | 2.5 | - | nH |
| L_S | internal source inductance | from source lead to source bonding pad | - | 7.5 | - | nH |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 25 A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$; see Figure 16 | - | 0.77 | 1.2 | V |
| t_{rr} | reverse recovery time | $I_S = 20 A; dI_S/dt = -100 A/\mu s; V_{GS} = 0 V$; $V_{DS} = 25 V$ | - | 70 | - | ns |
| Q_r | recovered charge | | - | 202 | - | nC |

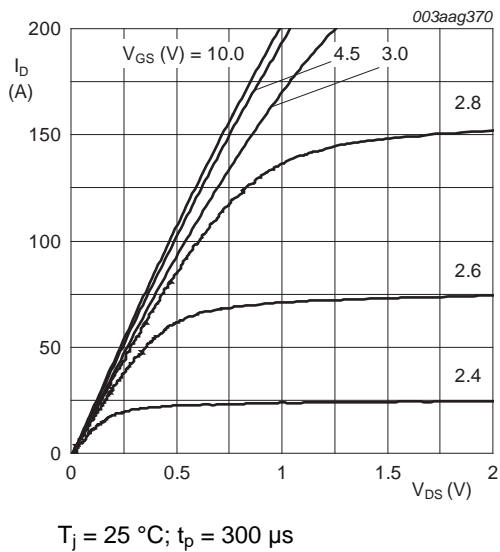


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values

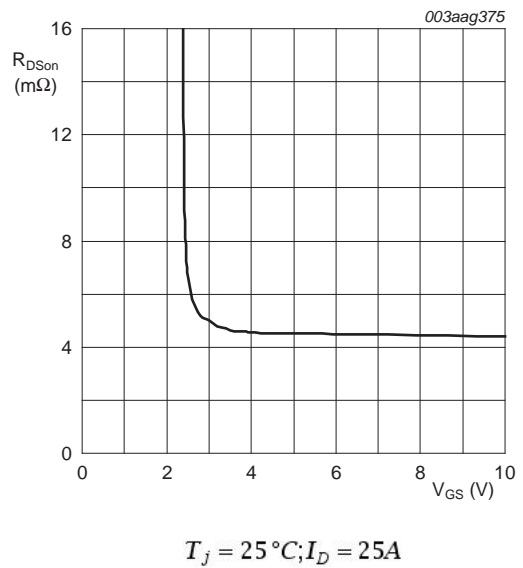


Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

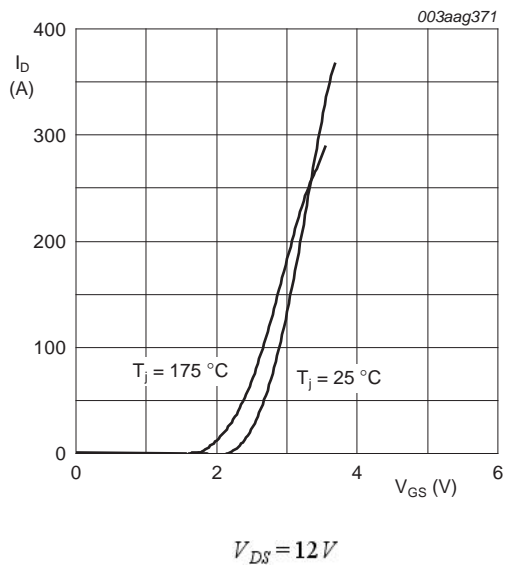


Fig 8. Transfer characteristics: drain current as a function of gate-source voltage; typical values

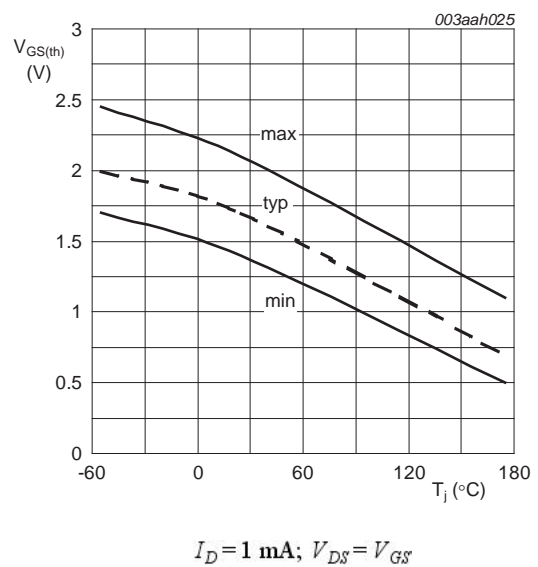
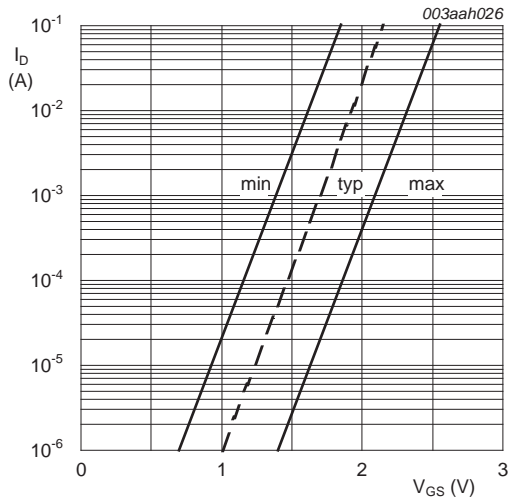
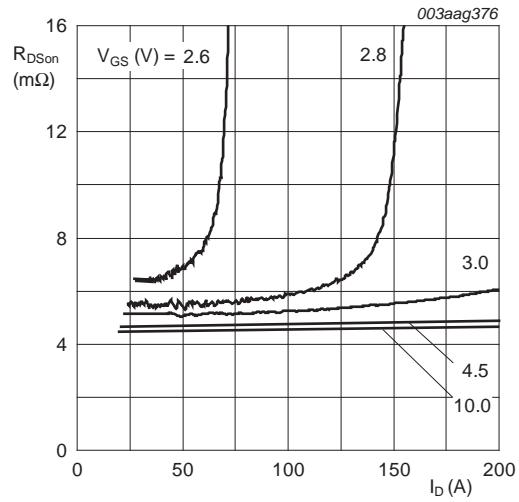


Fig 9. Gate-source threshold voltage as a function of junction temperature



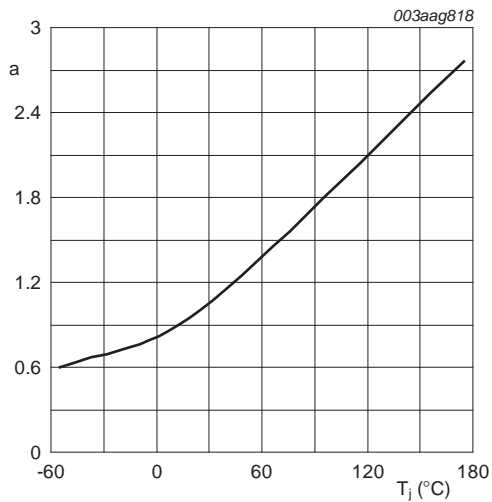
$T_j = 25^\circ\text{C}; V_{DS} = 5V$

Fig 10. Sub-threshold drain current as a function of gate-source voltage



$T_j = 25^\circ\text{C}; t_p = 300 \mu\text{s}$

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



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

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

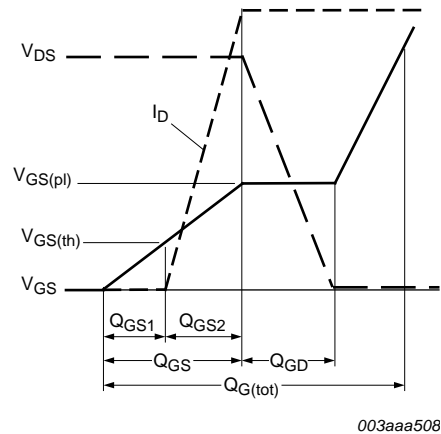
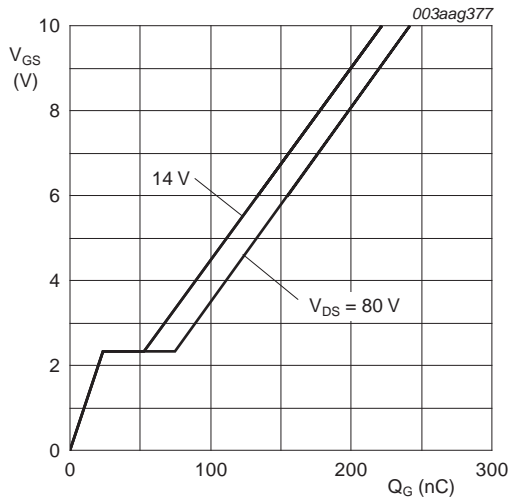
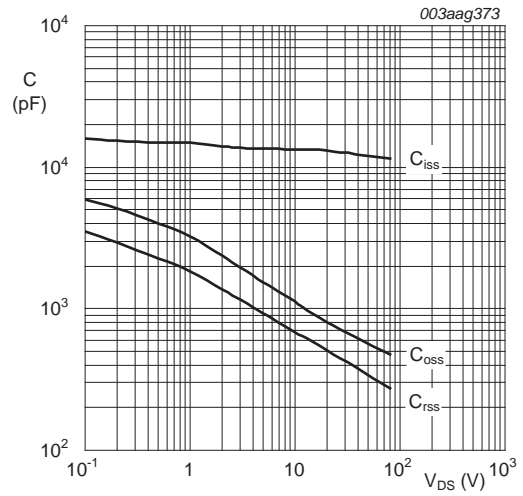


Fig 13. Gate charge waveform definitions



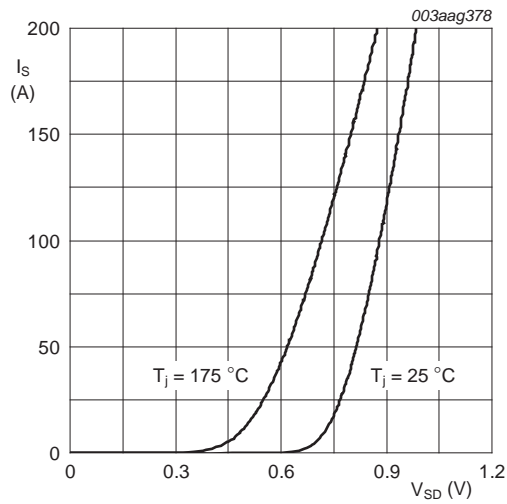
$T_j = 25$ °C; $I_D = 25$ A

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



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

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



$V_{GS} = 0$ V

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

8. Package outline

Plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)

SOT404



Fig 17. Package outline SOT404 (D2PAK)

9. Revision history

Table 8. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|-------------------|---|----------------------|---------------|-------------------|
| BUK965R8-100E v.2 | 20120516 | Product data sheet | - | BUK965R8-100E v.1 |
| Modifications: | <ul style="list-style-type: none">• Status changed from objective to product.• Various changes to content. | | | |
| BUK965R8-100E v.1 | 20120404 | Objective data sheet | - | - |

10. Legal information

10.1 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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