



PSMN0R9-30YLD

N-channel 30 V, 0.87 m Ω , 300 A logic level MOSFET in LFPAK56 using NextPowerS3 Technology

14 December 2015

Product data sheet

1. General description

300 Amp Logic level gate drive N-channel enhancement mode MOSFET in LFPAK56 package. NextPowerS3 portfolio utilising Nexperia's unique "SchottkyPlus" technology delivers high efficiency, low spiking performance usually associated with MOSFETs with an integrated Schottky or Schottky-like diode but without problematic high leakage current. NextPowerS3 is particularly suited to high efficiency applications at high switching frequencies.

2. Features and benefits

- 300 Amp capability
- Avalanche rated, 100 % tested at $I(as) = 190$ Amps
- Ultra low Q_G , Q_{GD} and Q_{OSS} for high system efficiency, especially at higher switching frequencies
- Superfast switching with soft-recovery; s-factor > 1
- Low spiking and ringing for low EMI designs
- Unique "SchottkyPlus" technology; Schottky-like performance with < 1 μA leakage at 25 °C
- Optimised for 4.5 V gate drive
- Low parasitic inductance and resistance
- High reliability clip bonded and solder die attach Power SO8 package; no glue, no wire bonds, qualified to 150 °C
- Wave solderable; exposed leads for optimal visual solder inspection

3. Applications

- On-board DC-to-DC solutions for server and telecommunications
- Secondary-side synchronous rectification in telecommunication applications
- Voltage regulator modules (VRM)
- Point-of-Load (POL) modules
- Power delivery for V-core, ASIC, DDR, GPU, VGA and system components
- Brushed and brushless motor control
- Power OR-ing

4. Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------|----------------------|----------------------------------|-----|-----|-----|------|
| V_{DS} | drain-source voltage | 25 °C \leq T_j \leq 150 °C | - | - | 30 | V |

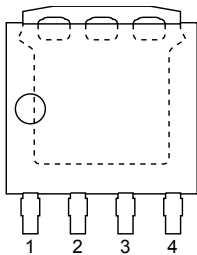
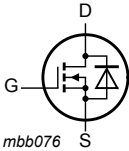
N-channel 30 V, 0.87 mΩ, 300 A logic level MOSFET in LFAK56 using NextPowerS3 Technology

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|--|-----|------|------|------|
| I_D | drain current | $T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; Fig. 2 | [1] | - | 300 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; Fig. 1 | - | - | 291 | W |
| T_j | junction temperature | | -55 | - | 150 | °C |
| Static characteristics | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; Fig. 10 | - | 0.79 | 1.09 | mΩ |
| | | $V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; Fig. 10 | - | 0.65 | 0.87 | mΩ |
| Dynamic characteristics | | | | | | |
| Q_{GD} | gate-drain charge | $V_{GS} = 4.5\text{ V}$; $I_D = 25\text{ A}$; $V_{DS} = 15\text{ V}$; Fig. 12 ; Fig. 13 | - | 13.5 | - | nC |
| $Q_{G(tot)}$ | total gate charge | $V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $V_{DS} = 15\text{ V}$; Fig. 12 ; Fig. 13 | - | 109 | - | nC |
| Source-drain diode | | | | | | |
| S | softness factor | $I_S = 25\text{ A}$; $V_{GS} = 0\text{ V}$; $di_S/dt = -100\text{ A}/\mu\text{s}$; $V_{DS} = 15\text{ V}$; Fig. 16 | - | 0.9 | - | |

[1] 300A Continuous current has been successfully demonstrated during application tests. Practically the current will be limited by PCB, Thermal design and operating temperature.

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-----------------------------------|--|---|
| 1 | S | source |  <p>LFAK56; Power-SO8 (SOT1023)</p> |  <p>mbb076</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 |
| PSMN0R9-30YLD | LFAK56; Power-SO8 | Plastic single-ended surface-mounted package (LFAK56); 4 leads | SOT1023 |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|---------------|--------------|
| PSMN0R9-30YLD | 0D930L |

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 | $25\text{ °C} \leq T_j \leq 150\text{ °C}$ | | - | 30 | V |
| V_{DGR} | drain-gate voltage | $25\text{ °C} \leq T_j \leq 150\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$ | | - | 30 | V |
| V_{GS} | gate-source voltage | | | -20 | 20 | V |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; Fig. 1 | | - | 291 | W |
| I_D | drain current | $V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; Fig. 2 | [1] | - | 300 | A |
| | | $V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ °C}$; Fig. 2 | | - | 284 | A |
| I_{DM} | peak drain current | pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$; Fig. 3 | | - | 1800 | A |
| T_{stg} | storage temperature | | | -55 | 150 | °C |
| T_j | junction temperature | | | -55 | 150 | °C |
| $T_{sld(M)}$ | peak soldering temperature | | | - | 260 | °C |
| V_{ESD} | electrostatic discharge voltage | HBM | | 2000 | - | V |
| Source-drain diode | | | | | | |
| I_S | source current | $T_{mb} = 25\text{ °C}$ | | - | 242 | A |
| I_{SM} | peak source current | pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$ | | - | 1800 | A |
| Avalanche ruggedness | | | | | | |
| I_{AS} | non-repetitive avalanche current | $V_{sup} \leq 30\text{ V}$; $V_{GS} = 10\text{ V}$; $T_{j(init)} = 25\text{ °C}$; [2] $R_{GS} = 50\text{ }\Omega$ | | - | 190 | A |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $V_{GS} = 10\text{ V}$; $T_{j(init)} = 25\text{ °C}$; $I_D = 25\text{ A}$; $V_{sup} \leq 30\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped; $t_p = 6.1\text{ ms}$ | [2] | - | 2987 | mJ |

[1] 300A Continuous current has been successfully demonstrated during application tests. Practically the current will be limited by PCB, Thermal design and operating temperature.

[2] Protected by 100% test

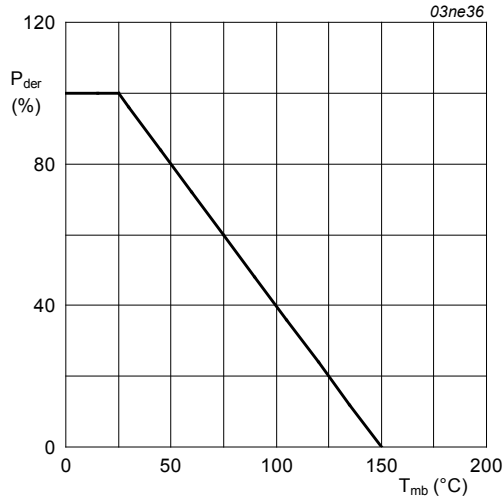
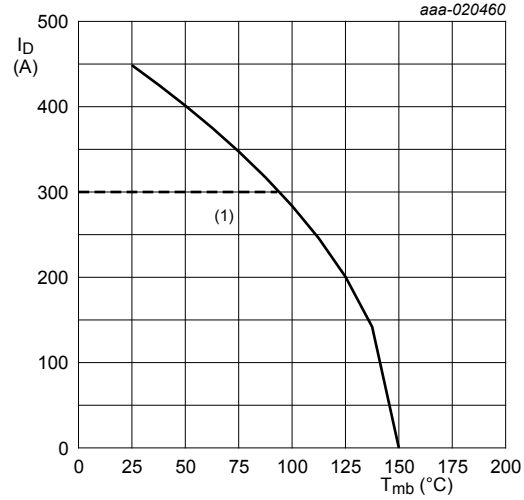


Fig. 1. Normalized total power dissipation as a function of mounting base temperature

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



(1) 300A continuous current has been successfully demonstrated during application tests. Practically the current will be limited by PCB, Thermal design and operating temperature

Fig. 2. Continuous drain current as a function of mounting base temperature

$$V_{GS} \geq 10V$$

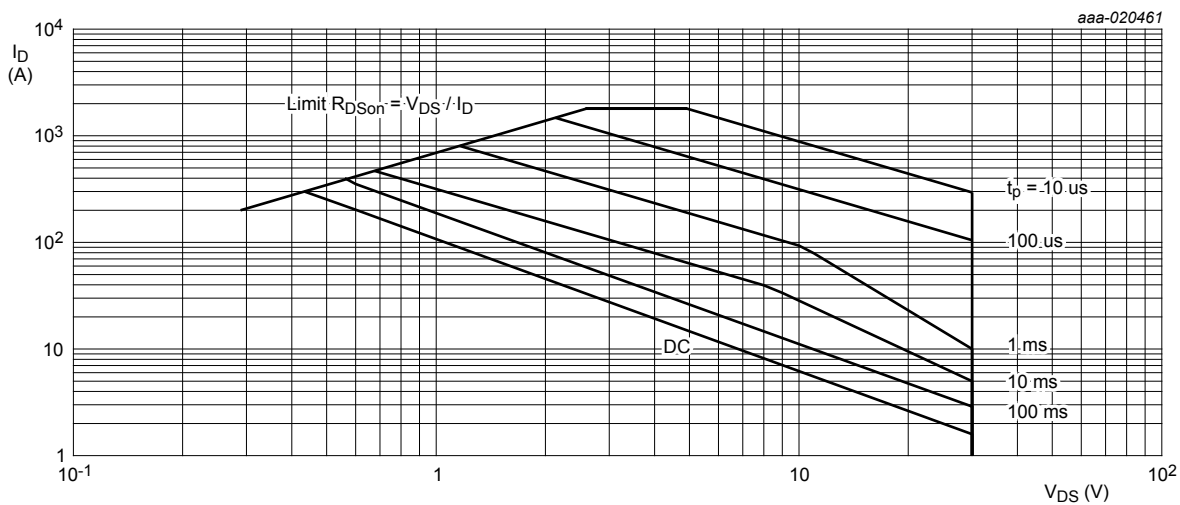


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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

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. 4 | - | 0.35 | 0.43 | K/W |

N-channel 30 V, 0.87 mΩ, 300 A logic level MOSFET in LPAK56 using NextPowerS3 Technology

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------|---|------------------------|-----|-----|-----|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | Fig. 5 | - | 50 | - | K/W |
| | | Fig. 6 | - | 125 | - | K/W |

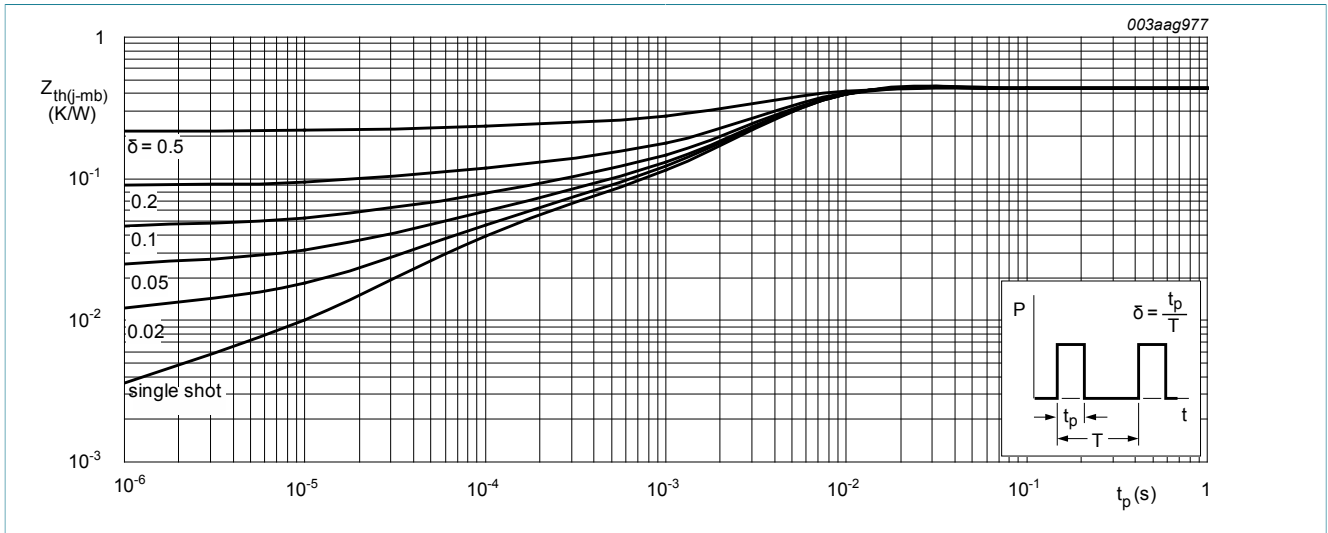


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

aaa-005750

aaa-005751

Fig. 5. PCB layout for thermal resistance junction to ambient 1" square pad; FR4 Board; 2oz copper

Fig. 6. PCB layout for thermal resistance junction to ambient minimum footprint; FR4 Board; 2oz copper

10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------|--------------------------------|--|-----|-----|-----|------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$ | 30 | - | - | V |
| | | $I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$ | 27 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C$ | 1.2 | 1.5 | 2.2 | V |

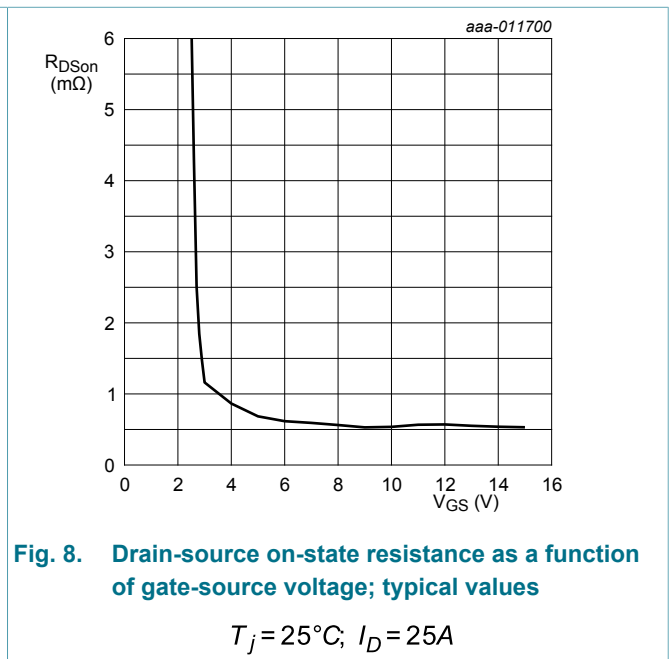
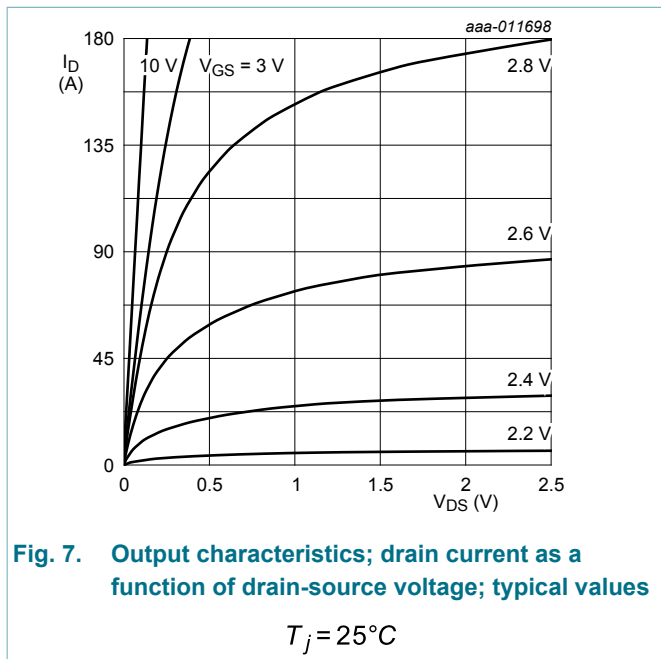
**N-channel 30 V, 0.87 mΩ, 300 A logic level MOSFET in LPAK56 using
NextPowerS3 Technology**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--|---|-----|------|------|------|
| $\Delta V_{GS(th)}/\Delta T$ | gate-source threshold voltage variation with temperature | $25\text{ °C} \leq T_j \leq 150\text{ °C}$ | - | -4.5 | - | mV/K |
| I_{DSS} | drain leakage current | $V_{DS} = 24\text{ V}; V_{GS} = 0\text{ V}; T_j = 25\text{ °C}$ | - | - | 1 | μA |
| | | $V_{DS} = 24\text{ V}; V_{GS} = 0\text{ V}; T_j = 125\text{ °C}$ | - | 3.7 | - | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 16\text{ V}; V_{DS} = 0\text{ V}; T_j = 25\text{ °C}$ | - | - | 100 | nA |
| | | $V_{GS} = -16\text{ V}; V_{DS} = 0\text{ V}; T_j = 25\text{ °C}$ | - | - | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ °C};$ Fig. 10 | - | 0.79 | 1.09 | mΩ |
| | | $V_{GS} = 4.5\text{ V}; I_D = 25\text{ A}; T_j = 150\text{ °C};$ Fig. 10; Fig. 11 | - | - | 1.8 | mΩ |
| | | $V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ °C};$ Fig. 10 | - | 0.65 | 0.87 | mΩ |
| | | $V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 150\text{ °C};$ Fig. 10; Fig. 11 | - | - | 1.44 | mΩ |
| R_G | internal gate resistance (AC) | $f = 1\text{ MHz}$ | - | 1.4 | - | Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 25\text{ A}; V_{DS} = 15\text{ V}; V_{GS} = 10\text{ V};$ Fig. 12; Fig. 13 | - | 109 | - | nC |
| | | $I_D = 25\text{ A}; V_{DS} = 15\text{ V}; V_{GS} = 4.5\text{ V};$ Fig. 12; Fig. 13 | - | 51 | - | nC |
| | | $I_D = 0\text{ A}; V_{DS} = 0\text{ V}; V_{GS} = 0\text{ V}$ | - | 99 | - | nC |
| Q_{GS} | gate-source charge | $I_D = 25\text{ A}; V_{DS} = 15\text{ V}; V_{GS} = 4.5\text{ V};$ Fig. 12; Fig. 13 | - | 15.3 | - | nC |
| $Q_{GS(th)}$ | pre-threshold gate-source charge | | - | 10.5 | - | nC |
| $Q_{GS(th-pl)}$ | post-threshold gate-source charge | | - | 4.8 | - | nC |
| Q_{GD} | gate-drain charge | | - | 13.5 | - | nC |
| $V_{GS(pl)}$ | gate-source plateau voltage | $I_D = 25\text{ A}; V_{DS} = 15\text{ V};$ Fig. 12; Fig. 13 | - | 2.4 | - | V |
| C_{iss} | input capacitance | $V_{DS} = 15\text{ V}; V_{GS} = 0\text{ V}; f = 1\text{ MHz};$ | - | 7668 | - | pF |
| C_{oss} | output capacitance | $T_j = 25\text{ °C};$ Fig. 14 | - | 2914 | - | pF |
| C_{rss} | reverse transfer capacitance | | - | 445 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 15\text{ V}; R_L = 0.6\text{ Ω}; V_{GS} = 4.5\text{ V};$ $R_{G(ext)} = 5\text{ Ω}$ | - | 38.1 | - | ns |
| t_r | rise time | | - | 49.8 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 63 | - | ns |
| t_f | fall time | | - | 42.6 | - | ns |

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| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | |
|---------------------------|----------------------------|---|-----|-------|-----|------|----|
| Q_{oss} | output charge | $V_{GS} = 0\text{ V}; V_{DS} = 15\text{ V}; f = 1\text{ MHz}; T_{mb} = 25\text{ °C}$ | - | 83.11 | - | nC | |
| Source-drain diode | | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 25\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ °C}; \text{Fig. 15}$ | - | 0.76 | 1.2 | V | |
| t_{rr} | reverse recovery time | $I_S = 25\text{ A}; di_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V}; V_{DS} = 15\text{ V}; \text{Fig. 16}$ | - | 52 | - | ns | |
| Q_r | recovered charge | | [1] | - | 67 | - | nC |
| t_a | reverse recovery rise time | | - | 27.4 | - | ns | |
| t_b | reverse recovery fall time | | - | 24.7 | - | ns | |
| S | softness factor | | - | 0.9 | - | | |

[1] includes capacitive recovery



N-channel 30 V, 0.87 mΩ, 300 A logic level MOSFET in LPAK56 using NextPowerS3 Technology

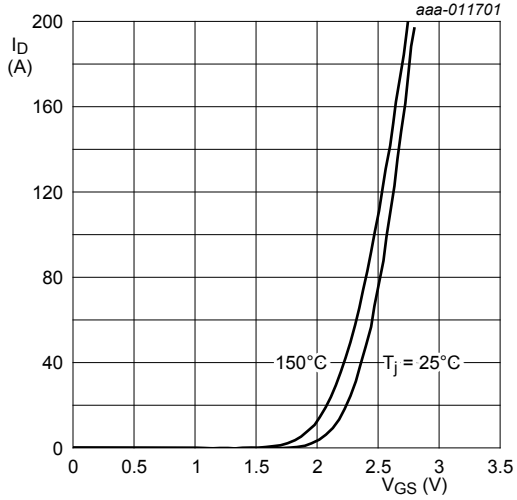


Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

$$V_{DS} = 12V$$

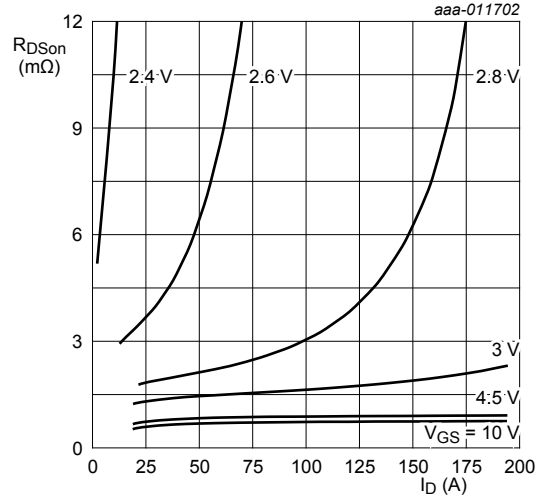


Fig. 10. Drain-source on-state resistance as a function of drain current; typical values

$$T_j = 25^\circ C$$

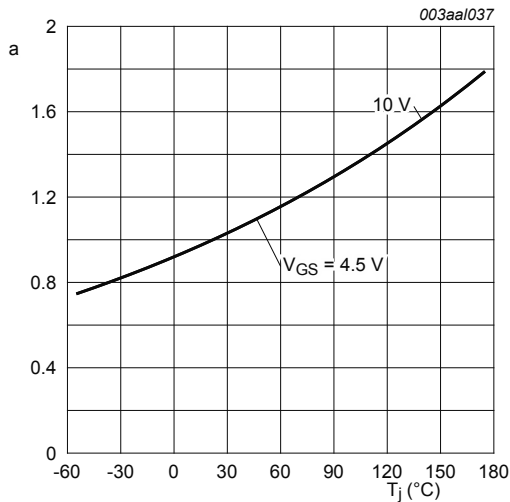


Fig. 11. Normalized drain-source on-state resistance factor as a function of junction temperature

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

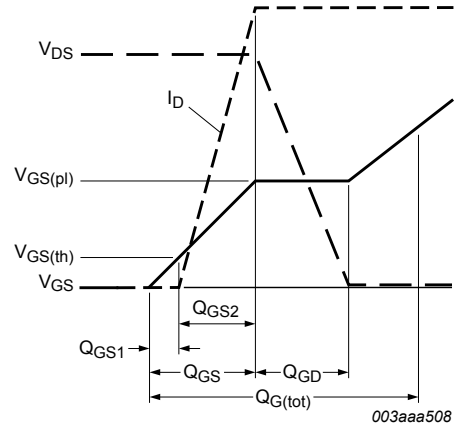


Fig. 12. MOSFET transistor: Gate charge waveform definitions

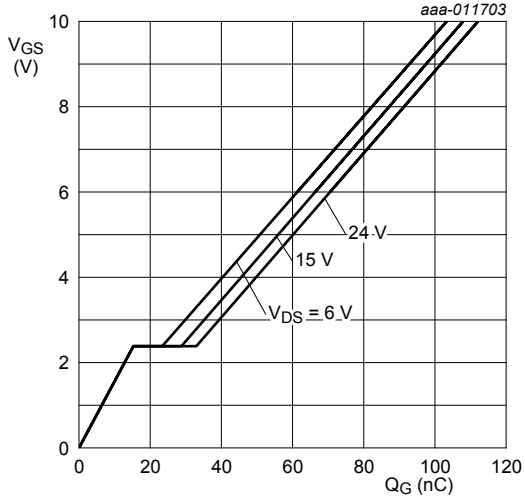


Fig. 13. Gate-source voltage as a function of gate charge; typical values

$T_j = 25^\circ C; I_D = 25A$

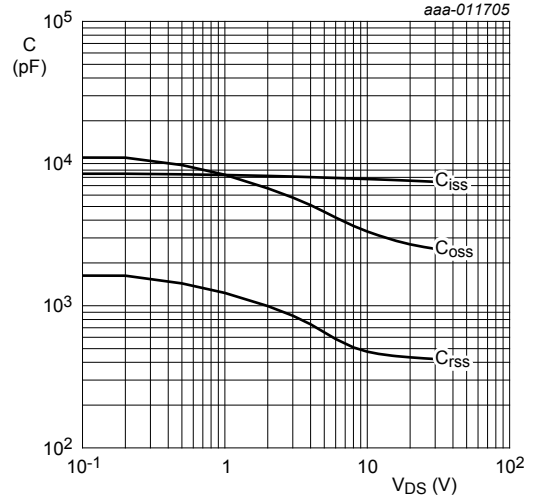


Fig. 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

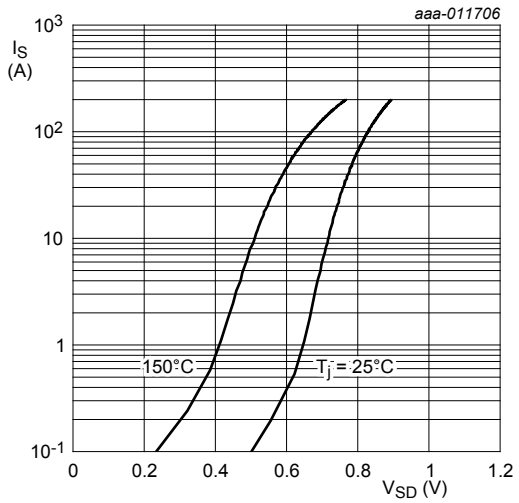


Fig. 15. Source current as a function of source-drain voltage; typical values

$V_{GS} = 0V$

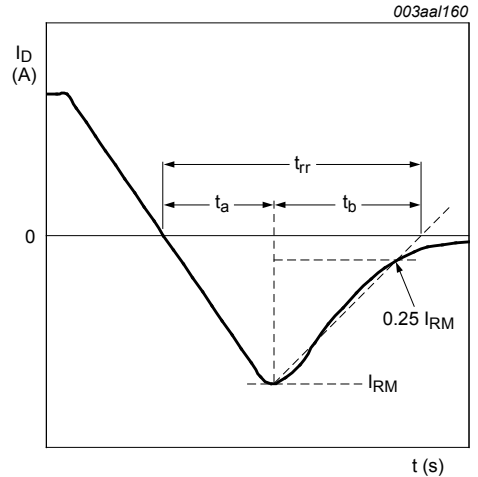


Fig. 16. Reverse recovery timing definition

11. Package outline

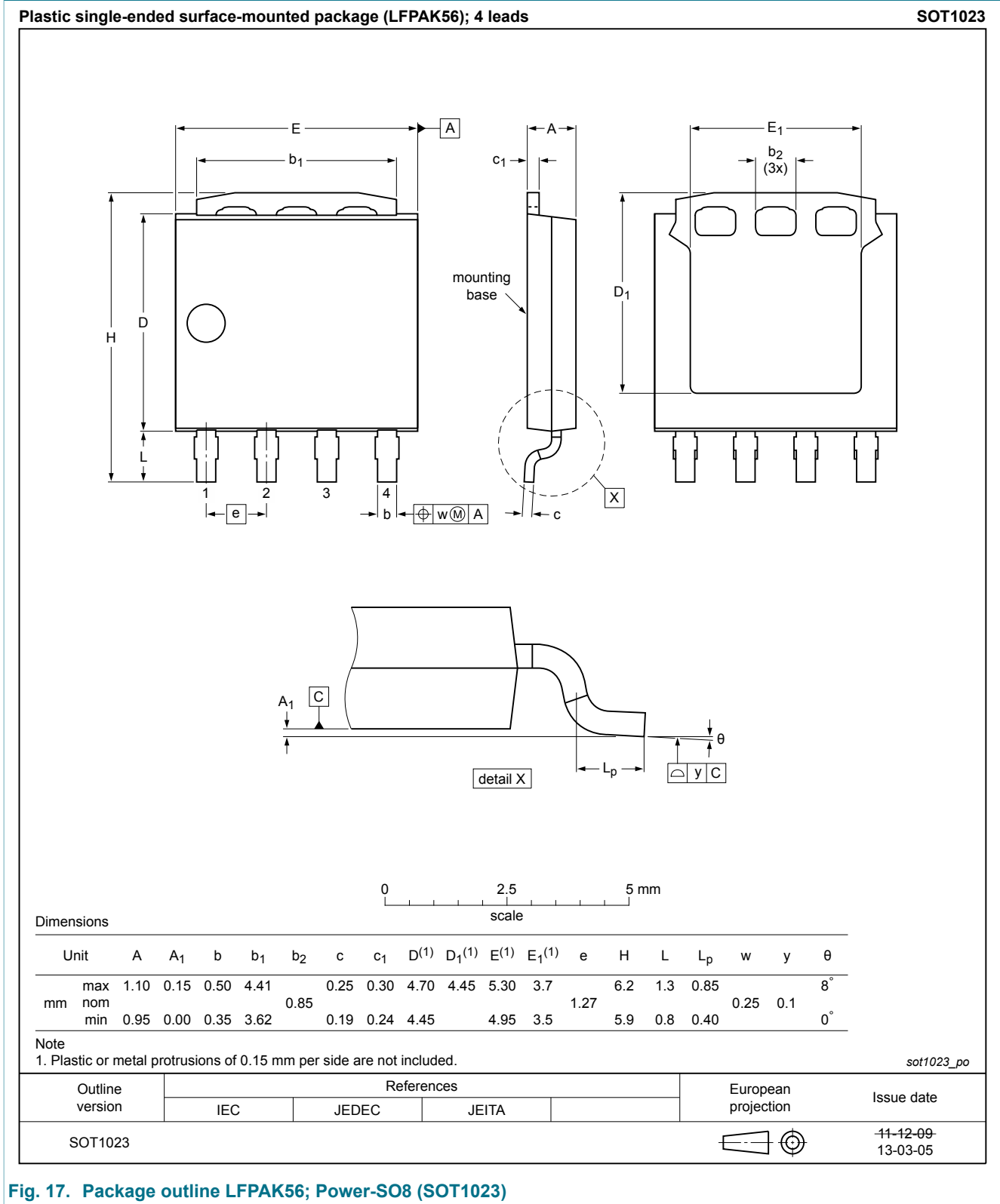


Fig. 17. Package outline LPAK56; Power-SO8 (SOT1023)

12. Legal information

12.1 Data sheet status

| Document status [1][2] | Product status [3] | Definition |
|--------------------------------|--------------------|---|
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| 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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- [2] The term 'short data sheet' is explained in section "Definitions".
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13. Contents

| | | |
|------|-------------------------------|----|
| 1 | General description | 1 |
| 2 | Features and benefits | 1 |
| 3 | Applications | 1 |
| 4 | Quick reference data | 1 |
| 5 | Pinning information | 2 |
| 6 | Ordering information | 2 |
| 7 | Marking | 3 |
| 8 | Limiting values | 3 |
| 9 | Thermal characteristics | 4 |
| 10 | Characteristics | 5 |
| 11 | Package outline | 10 |
| 12 | Legal information | 11 |
| 12.1 | Data sheet status | 11 |
| 12.2 | Definitions | 11 |
| 12.3 | Disclaimers | 11 |
| 12.4 | Trademarks | 12 |

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For sales office addresses, please send an email to: salesaddresses@nexperia.com
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