



PSMN6R4-30MLD

N-channel 30 V, 6.4 mΩ logic level MOSFET in LPAK33 using NextPowerS3 Technology

21 January 2019

Product data sheet

1. General description

Logic level gate drive N-channel enhancement mode MOSFET in an LPAK33 package. The NextPowerS3 portfolio, utilising Nexperia's unique "SchottkyPlus" technology, delivers high efficiency and the low spiking performance usually associated with MOSFETs with an integrated Schottky or Schottky-like body diode but without problematic high leakage current. NextPowerS3 is particularly suited to high efficiency applications at high switching frequencies.

2. Features and benefits

- 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 μ A leakage at 25 °C
- Optimised for 4.5 V gate drive
- Low parasitic inductance and resistance
- High reliability clip bonded and solder die attach Mini Power SO8 package; no glue, no wire bonds, qualified to 175 °C
- 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

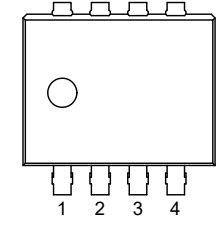
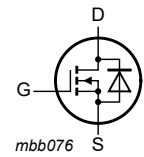
4. Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|--|-----|-----|-----|------|
| V_{DS} | drain-source voltage | $25\text{ °C} \leq T_j \leq 175\text{ °C}$ | - | - | 30 | V |
| I_D | drain current | $V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; Fig. 2 | - | - | 66 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; Fig. 1 | - | - | 51 | W |
| Static characteristics | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}$; $I_D = 15\text{ A}$; $T_j = 25\text{ °C}$; Fig. 10 | - | 6.9 | 8.3 | mΩ |
| Dynamic characteristics | | | | | | |
| Q_{GD} | gate-drain charge | $I_D = 15\text{ A}$; $V_{DS} = 15\text{ V}$; $V_{GS} = 4.5\text{ V}$; Fig. 12 ; Fig. 13 | - | 1.8 | 3 | nC |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-----------------------------------|---|---|
| 1 | S | source |  <p>LFAK33 (SOT1210)</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 |
| PSMN6R4-30MLD | LFAK33 | Plastic single ended surface mounted package (LFAK33); 8 leads | SOT1210 |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|---------------|--------------|
| PSMN6R4-30MLD | 6D430L |

8. Limiting values

Table 5. Limiting values

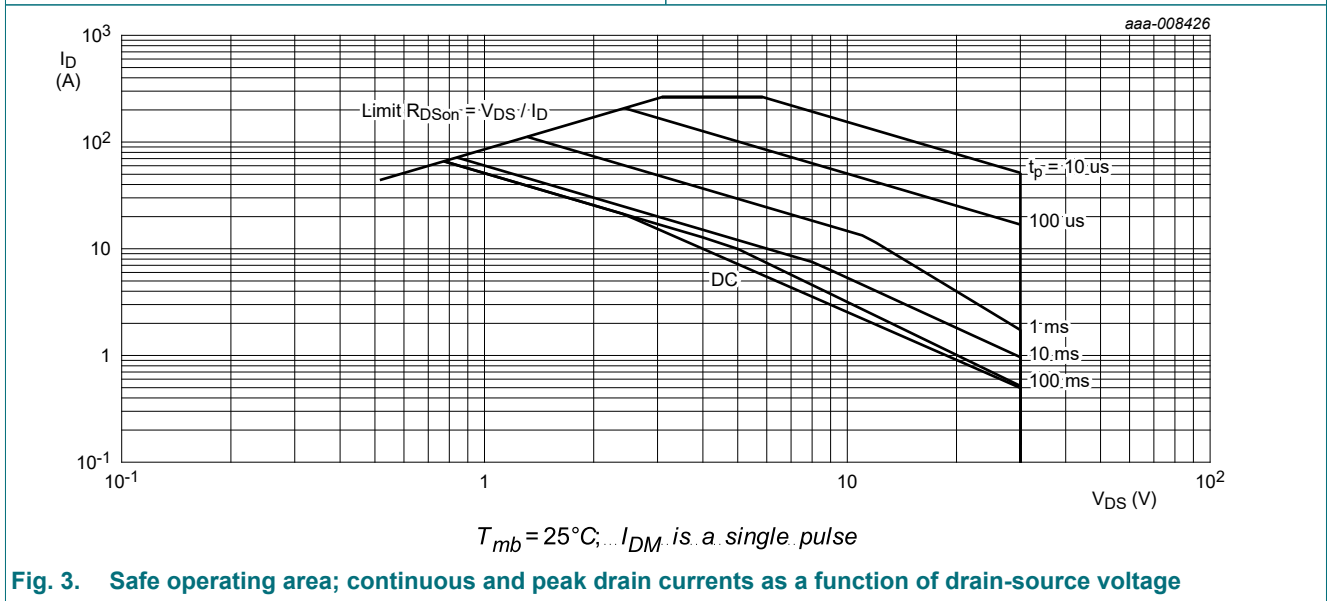
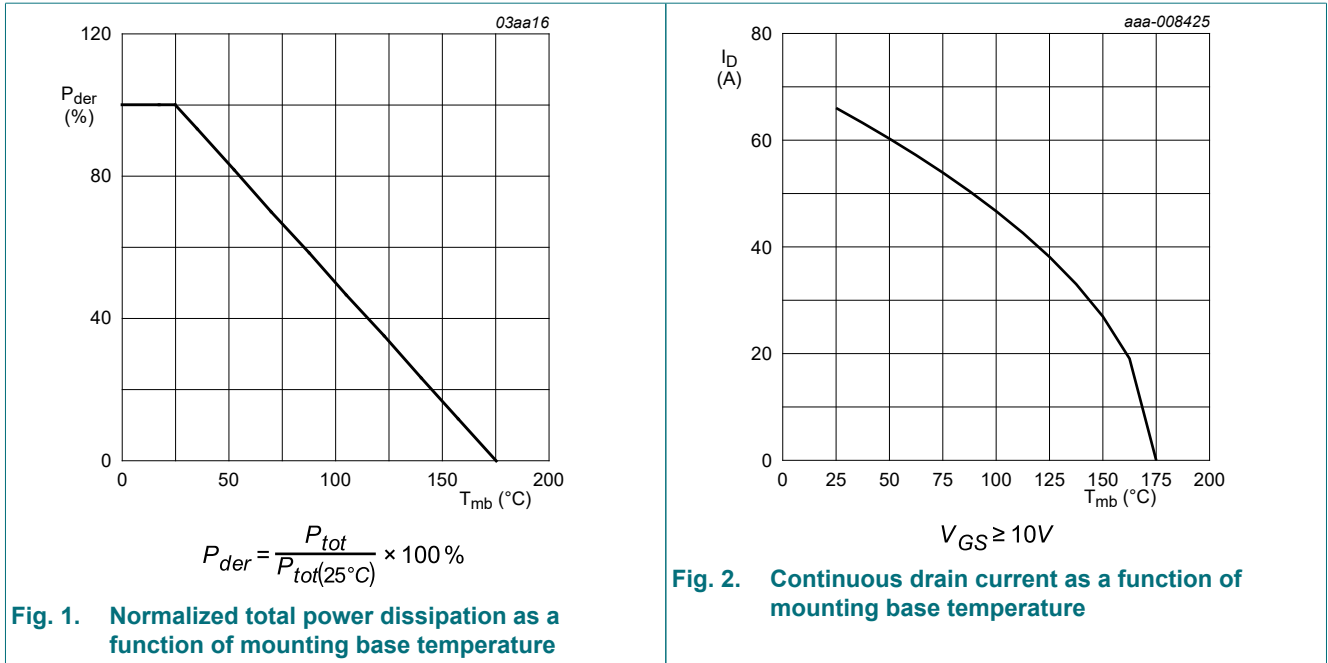
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------------------------|----------------------------|---|-----|-----|------|
| V_{DS} | drain-source voltage | $25\text{ °C} \leq T_j \leq 175\text{ °C}$ | - | 30 | V |
| V_{DGR} | drain-gate voltage | $25\text{ °C} \leq T_j \leq 175\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$ | - | 30 | V |
| V_{GS} | gate-source voltage | | -20 | 20 | V |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; Fig. 1 | - | 51 | W |
| I_D | drain current | $V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; Fig. 2 | - | 66 | A |
| | | $V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ °C}$; Fig. 2 | - | 47 | A |
| I_{DM} | peak drain current | pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$; Fig. 3 | - | 264 | A |
| T_{stg} | storage temperature | | -55 | 175 | °C |
| T_j | junction temperature | | -55 | 175 | °C |
| $T_{sld(M)}$ | peak soldering temperature | | - | 260 | °C |
| Source-drain diode | | | | | |
| I_S | source current | $T_{mb} = 25\text{ °C}$ | - | 43 | A |
| I_{SM} | peak source current | pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$ | - | 264 | A |
| Avalanche ruggedness | | | | | |

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| Symbol | Parameter | Conditions | Min | Max | Unit | |
|---------------|--|---|-----|-----|------|----|
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 15\text{ A}$; $V_{sup} \leq 30\text{ V}$; $R_{GS} = 50\ \Omega$; $V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$; unclamped; $t_p = 159\ \mu\text{s}$ | [1] | - | 46.6 | mJ |

[1] Protected by 100% test



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 | - | 2.72 | 2.94 | K/W |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------|---|------------|-----|-----|-----|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | Fig. 5 | - | 57 | - | K/W |
| | | Fig. 6 | - | 178 | - | K/W |

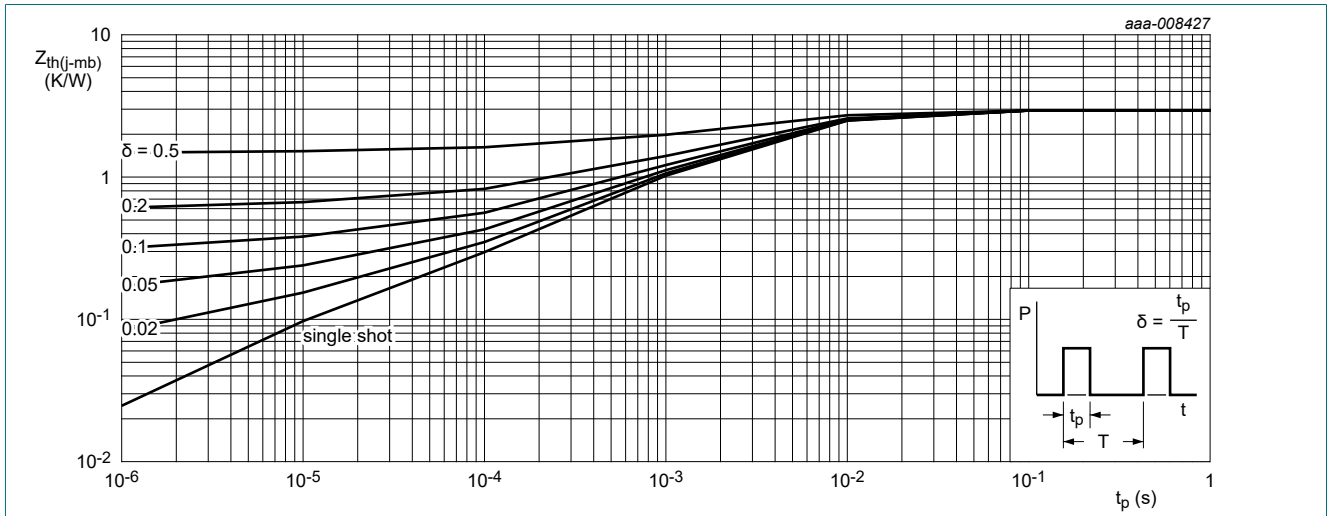


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

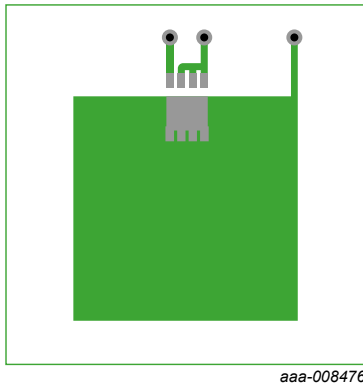


Fig. 5. PCB layout for thermal resistance junction to ambient 1" square pad; FR4 Board; 2oz copper

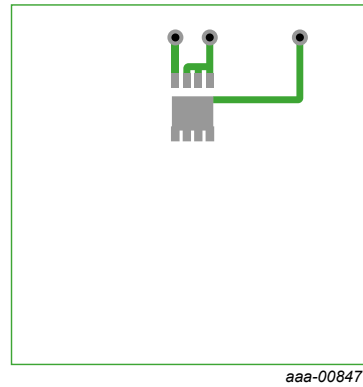


Fig. 6. PCB layout for thermal resistance junction to ambient minimum footprint; FR4 Board; 2oz copper

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 | 1.7 | 2.2 | V |
| $\Delta V_{GS(th)}/\Delta T$ | gate-source threshold voltage variation with temperature | $25 \text{ }^\circ C \leq T_j \leq 150 \text{ }^\circ C$ | - | -3.8 | - | mV/K |
| I_{DSS} | drain leakage current | $V_{DS} = 24 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$ | - | - | 1 | μA |
| | | $V_{DS} = 24 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ C$ | - | 0.45 | - | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 16 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$ | - | - | 100 | nA |

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| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|-----------------------------------|---|-----|------|------|------|
| | | $V_{GS} = -16\text{ V}; V_{DS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$ | - | - | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}; I_D = 15\text{ A}; T_j = 25\text{ }^\circ\text{C};$ Fig. 10 | - | 6.9 | 8.3 | mΩ |
| | | $V_{GS} = 4.5\text{ V}; I_D = 15\text{ A}; T_j = 150\text{ }^\circ\text{C};$ Fig. 10; Fig. 11 | - | - | 13.7 | mΩ |
| | | $V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 25\text{ }^\circ\text{C};$ Fig. 10 | - | 5.3 | 6.3 | mΩ |
| | | $V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 150\text{ }^\circ\text{C};$ Fig. 10; Fig. 11 | - | - | 10.4 | mΩ |
| R_G | gate resistance | $f = 1\text{ MHz}$ | - | 2.36 | 5.8 | Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 15\text{ A}; V_{DS} = 15\text{ V}; V_{GS} = 10\text{ V};$ Fig. 12; Fig. 13 | - | 13.7 | 19 | nC |
| | | $I_D = 15\text{ A}; V_{DS} = 15\text{ V}; V_{GS} = 4.5\text{ V};$ Fig. 12; Fig. 13 | - | 6.5 | 9 | nC |
| | | $I_D = 0\text{ A}; V_{DS} = 0\text{ V}; V_{GS} = 10\text{ V}$ | - | 12.2 | - | nC |
| Q_{GS} | gate-source charge | $I_D = 15\text{ A}; V_{DS} = 15\text{ V}; V_{GS} = 4.5\text{ V};$ Fig. 12; Fig. 13 | - | 1.7 | 4 | nC |
| $Q_{GS(th)}$ | pre-threshold gate-source charge | | - | 1.2 | - | nC |
| $Q_{GS(th-pl)}$ | post-threshold gate-source charge | | - | 0.5 | - | nC |
| Q_{GD} | gate-drain charge | | - | 1.8 | 3 | nC |
| $V_{GS(pl)}$ | gate-source plateau voltage | $I_D = 15\text{ A}; V_{DS} = 15\text{ V};$ Fig. 12; Fig. 13 | - | 2.2 | - | V |
| C_{iss} | input capacitance | $V_{DS} = 15\text{ V}; V_{GS} = 0\text{ V}; f = 1\text{ MHz};$ $T_j = 25\text{ }^\circ\text{C};$ Fig. 14 | - | 832 | - | pF |
| C_{oss} | output capacitance | | - | 587 | - | pF |
| C_{rss} | reverse transfer capacitance | | - | 64 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 15\text{ V}; R_L = 1\text{ }^\Omega; V_{GS} = 4.5\text{ V};$ $R_{G(ext)} = 5\text{ }^\Omega$ | - | 9 | - | ns |
| t_r | rise time | | - | 16.2 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 10.5 | - | ns |
| t_f | fall time | | - | 10.9 | - | ns |
| Q_{oss} | output charge | $V_{GS} = 0\text{ V}; V_{DS} = 15\text{ V}; f = 1\text{ MHz};$ $T_j = 25\text{ }^\circ\text{C}$ | - | 12.6 | - | nC |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 10\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C};$ Fig. 15 | - | 0.8 | 1.2 | V |
| t_{rr} | reverse recovery time | $I_S = 15\text{ A}; dI_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V};$ $V_{DS} = 15\text{ V};$ Fig. 16 | - | 23.4 | - | ns |
| Q_r | recovered charge | | [1] | 12.6 | - | nC |
| t_a | reverse recovery rise time | | - | 10.6 | - | ns |
| t_b | reverse recovery fall time | | - | 12.8 | - | ns |
| S | softness factor | | - | 1.2 | - | |

[1] includes capacitive recovery

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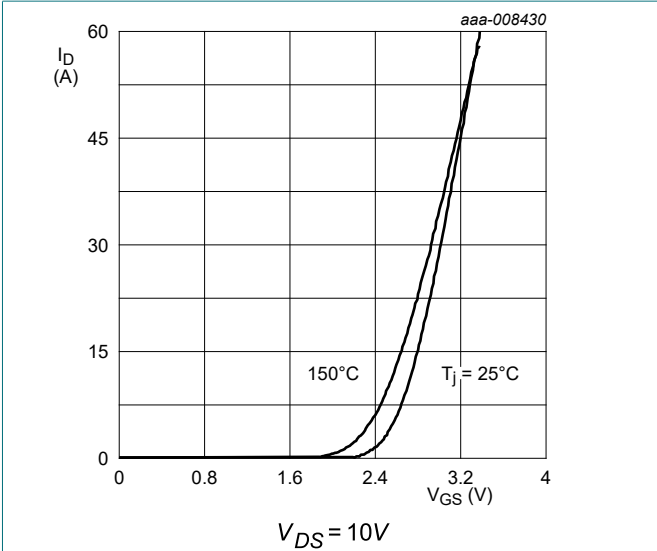


Fig. 7. Transfer characteristics; drain current as a function of gate-source voltage; typical values

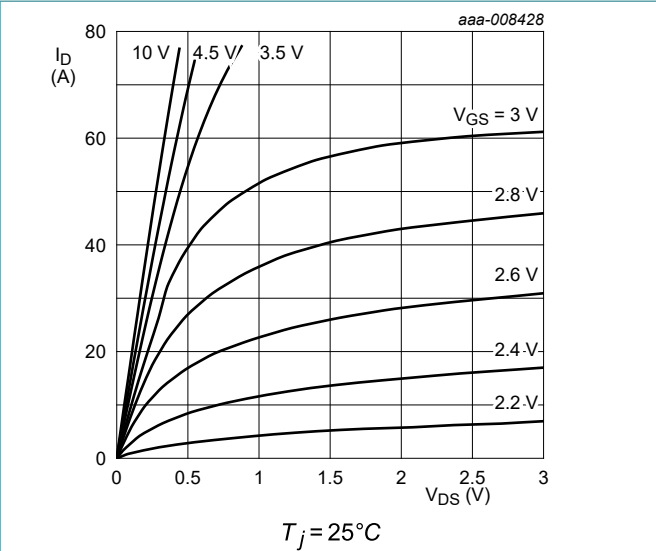


Fig. 8. Output characteristics; drain current as a function of drain-source voltage; typical values

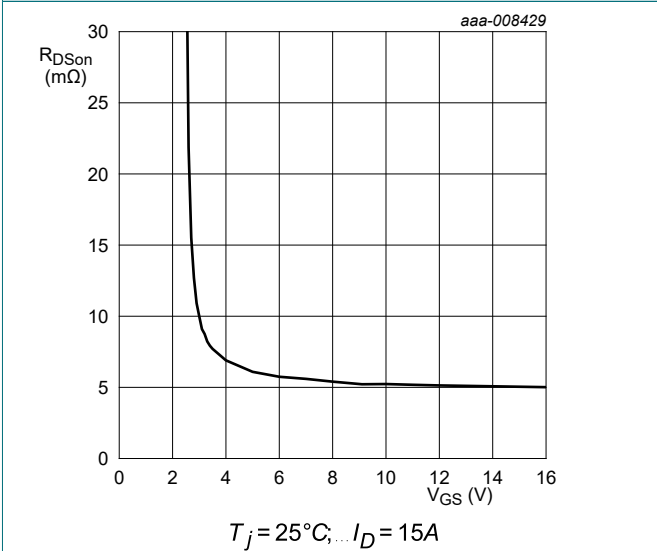


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

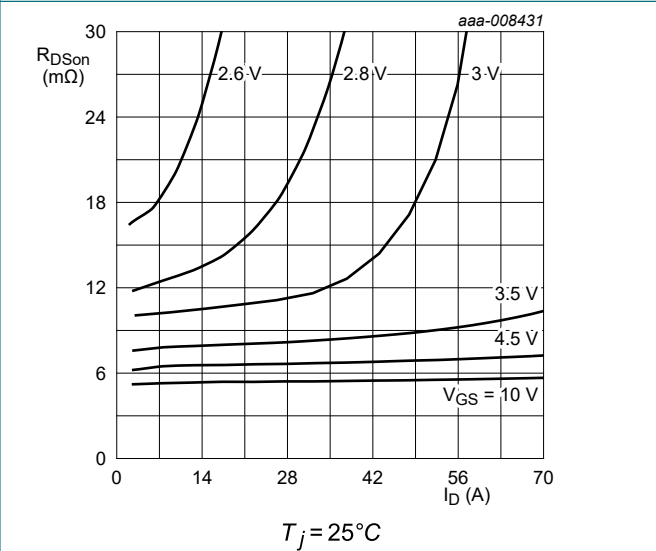
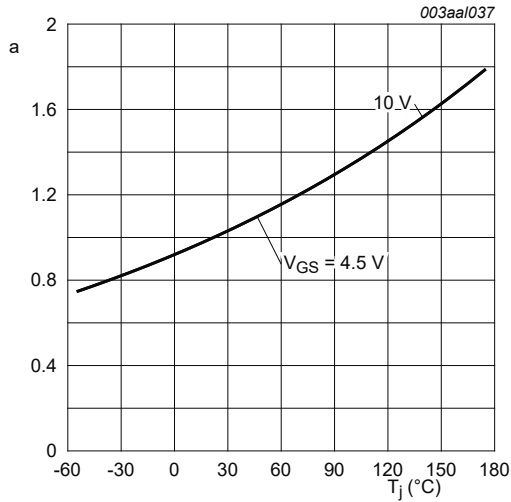


Fig. 10. Drain-source on-state resistance as a function of drain current; typical values



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

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

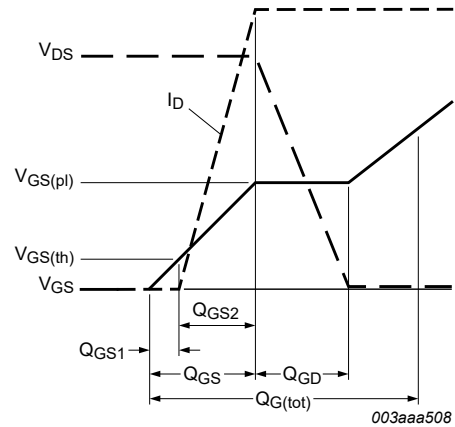


Fig. 12. Gate charge waveform definitions

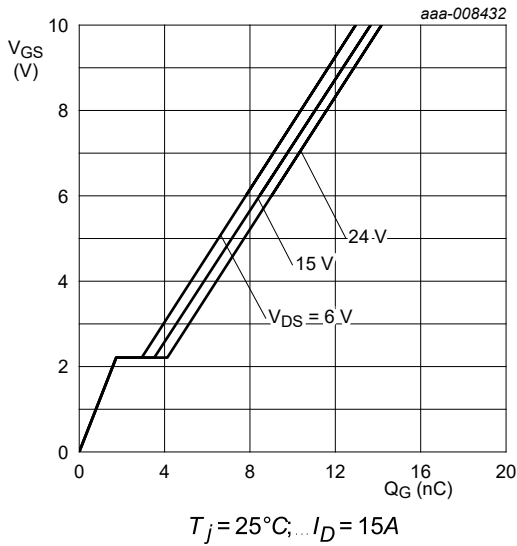


Fig. 13. Gate-source voltage as a function of gate charge; typical values

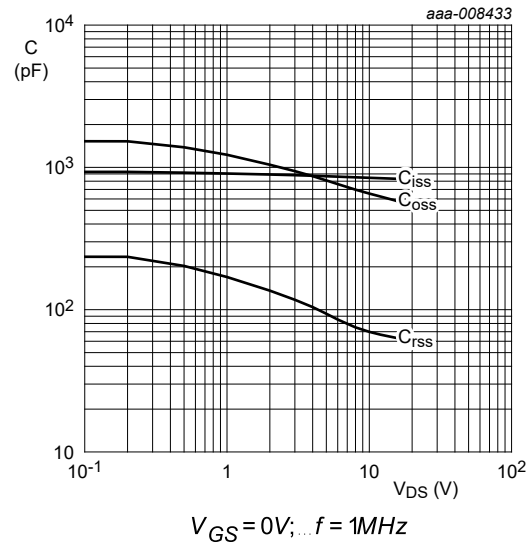
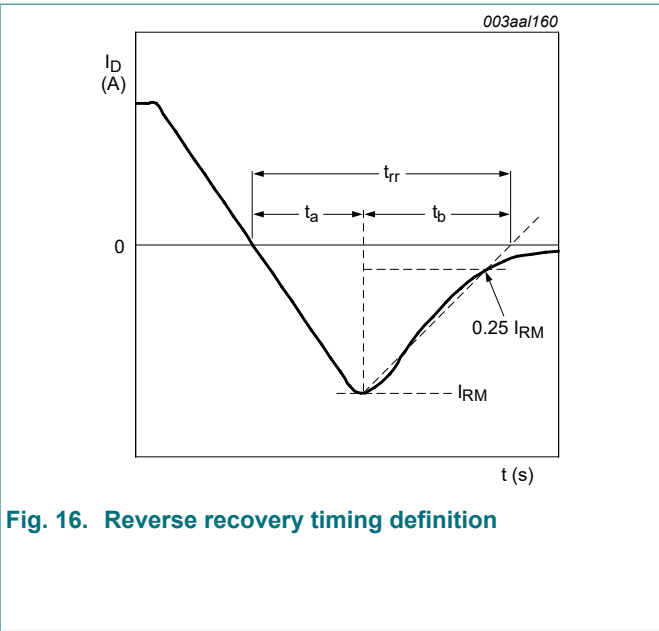
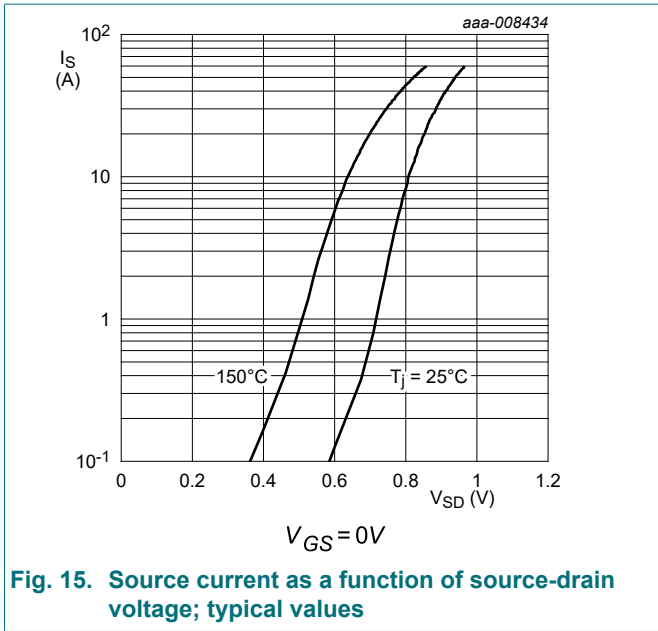


Fig. 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



11. Package outline

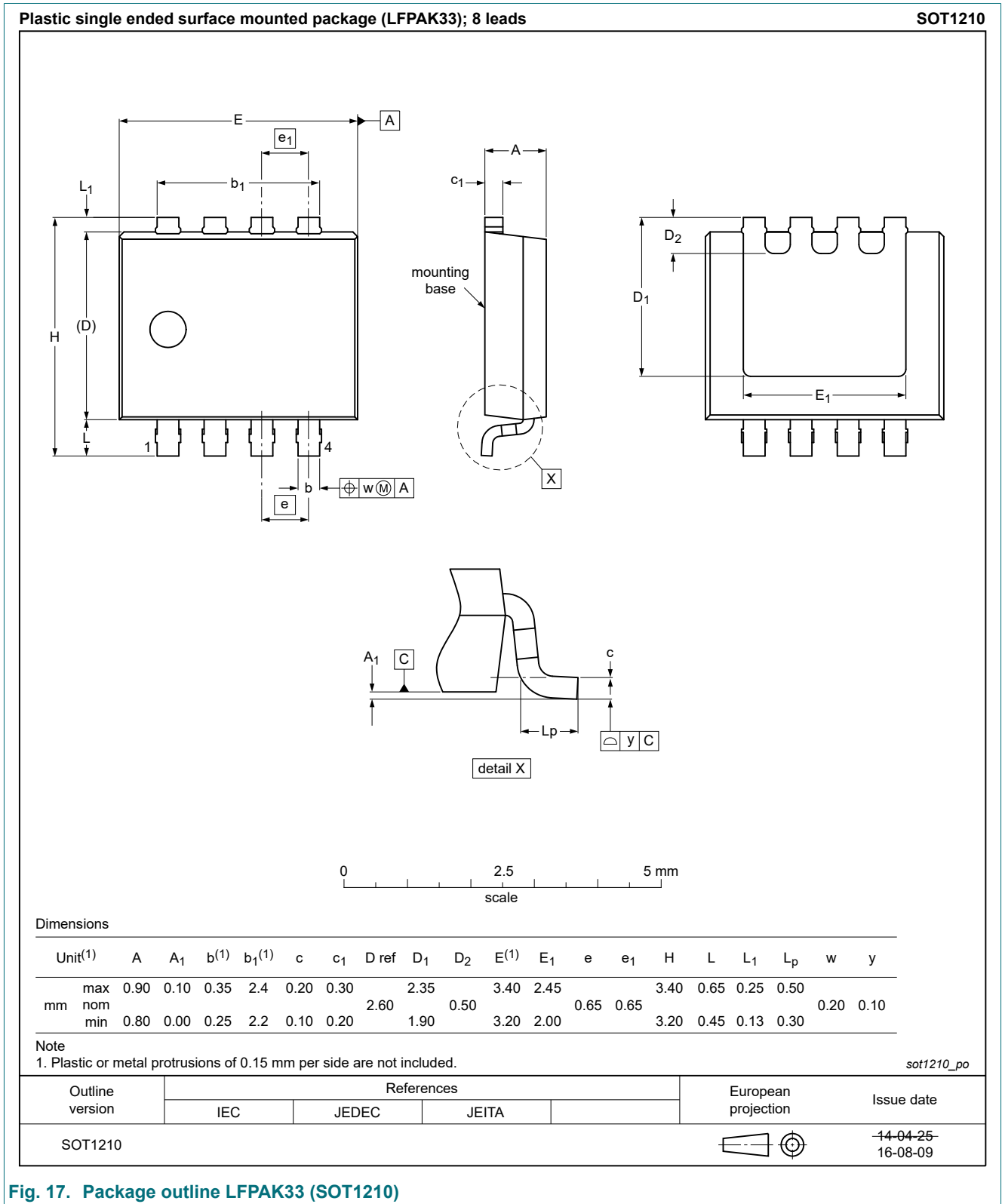


Fig. 17. Package outline LPAK33 (SOT1210)

12. Soldering

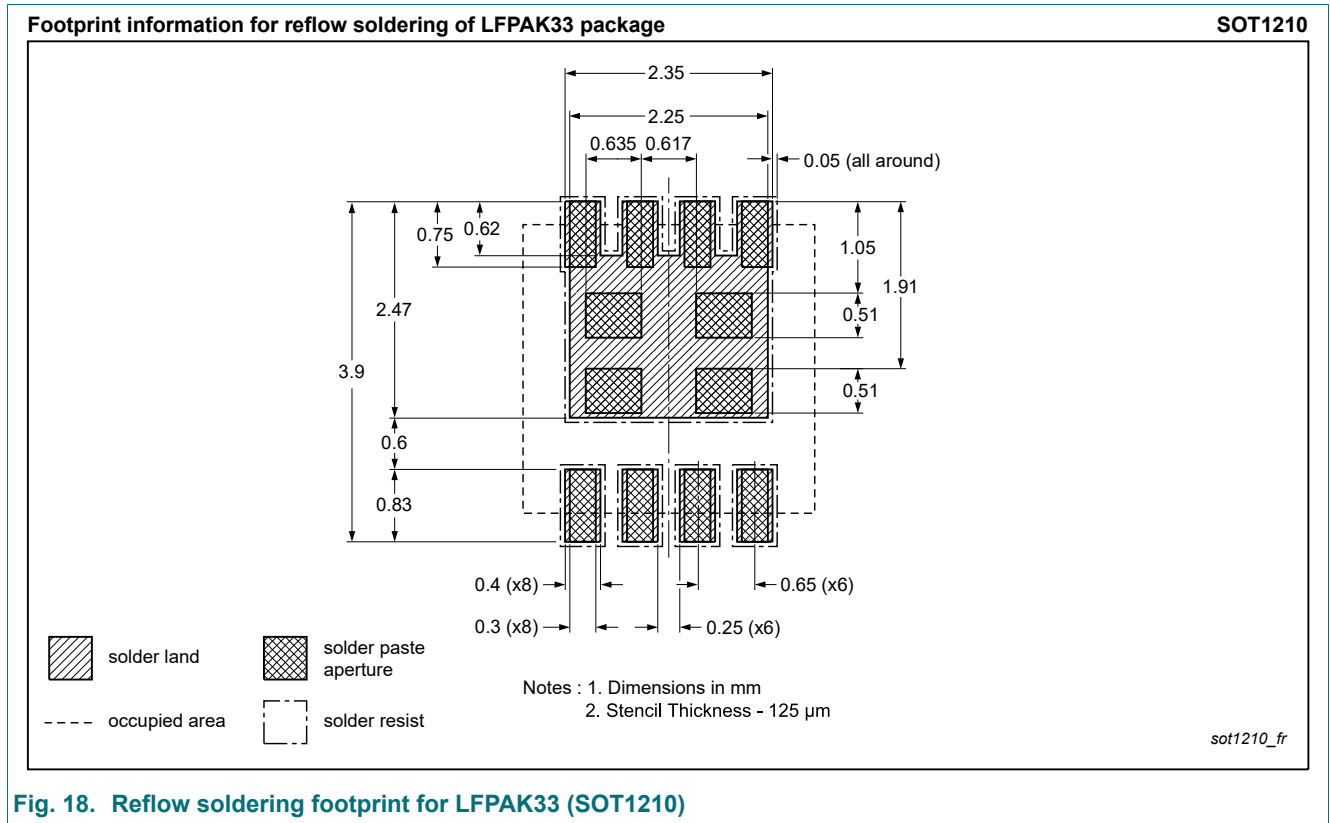


Fig. 18. Reflow soldering footprint for LFPAK33 (SOT1210)

13. Legal information

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|--------------------------------|--------------------|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
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