



# PXM017-30QL

30 V, N-channel Trench MOSFET

2 November 2020

Product data sheet

## 1. General description

N-channel enhancement mode Field-Effect Transistor (FET) in an MLPAK33 (SOT8002) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

## 2. Features and benefits

- Logic-level compatible
- Trench MOSFET technology
- Ultra low  $Q_G$  and  $Q_{GD}$  for high system efficiency, especially at higher switching frequencies
- Superfast switching with soft-recovery
- Low spiking and ringing for low EMI designs
- MLPAK33 package (3.3 x 3.3 mm footprint)

## 3. Applications

- DC to DC conversion
- Battery management
- Low-side load switch
- Switching circuits

## 4. Quick reference data

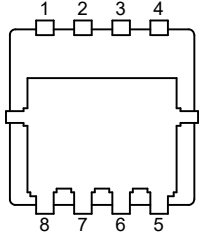
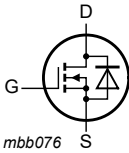
Table 1. Quick reference data

| Symbol                         | Parameter                        | Conditions  | Min | Typ  | Max  | Unit |
|--------------------------------|----------------------------------|---|-----|------|------|------|
| $V_{DS}$                       | drain-source voltage             | $T_j = 25\text{ °C}$  | -   | -    | 30   | V    |
| $V_{GS}$                       | gate-source voltage              |   | -20 | -    | 20   | V    |
| $I_D$                          | drain current                    | $V_{GS} = 10\text{ V}; T_{amb} = 25\text{ °C}; t \leq 5\text{ s}$                     | [1] | -    | 12   | A    |
| <b>Static characteristics</b>  |                                  |   |     |      |      |      |
| $R_{DS(on)}$                   | drain-source on-state resistance | $V_{GS} = 10\text{ V}; I_D = 7.9\text{ A}; T_j = 25\text{ °C}$                        | -   | 14.8 | 17.4 | mΩ   |
|                                |                                  | $V_{GS} = 4.5\text{ V}; I_D = 6.8\text{ A}; T_j = 25\text{ °C}$                       | -   | 18.5 | 23.1 | mΩ   |
| <b>Dynamic characteristics</b> |                                  |   |     |      |      |      |
| $Q_{G(tot)}$                   | total gate charge                | $V_{DS} = 15\text{ V}; I_D = 6.8\text{ A}; V_{GS} = 4.5\text{ V}; T_j = 25\text{ °C}$ | -   | 2.5  | 3.8  | nC   |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and mounting pad for drain 6 cm<sup>2</sup>.

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline   | Graphic symbol  |
|-----|--------|-------------|--|---|
| 1   | S      | source      |  <p>MLPAK33 (SOT8002-1)</p> |  |
| 2   | S      | source      |  |   |
| 3   | S      | source      |  |   |
| 4   | G      | gate        |  |   |
| 5   | D      | drain       |  |   |
| 6   | D      | drain       |  |   |
| 7   | D      | drain       |  |   |
| 8   | D      | drain       |  |   |

## 6. Ordering information

Table 3. Ordering information

| Type number | Package |   |           |
|-------------|---------|---|-----------|
|             | Name    | Description   | Version   |
| PXN017-30QL | MLPAK33 | plastic thermal enhanced surface mounted package; mini leads; 8 terminals; pitch 0.65 mm; 3.3 x 3.3 x 0.8 mm body | SOT8002-1 |

## 7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PXN017-30QL | 9AB          |

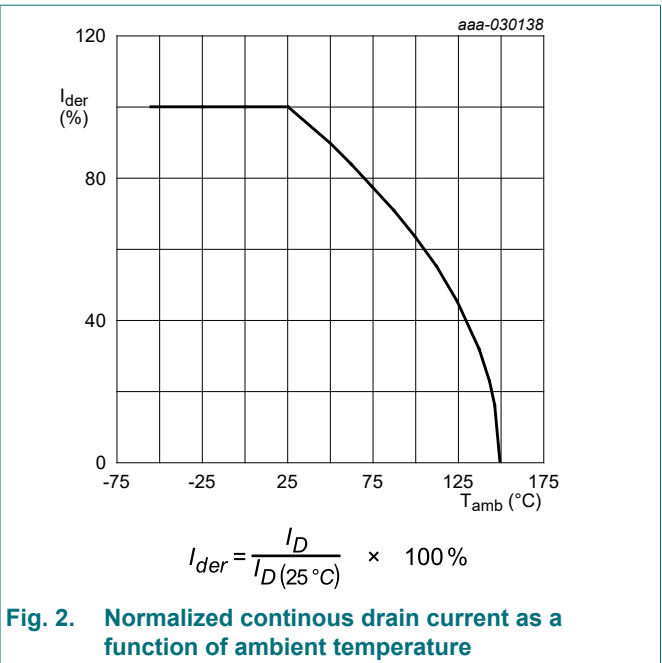
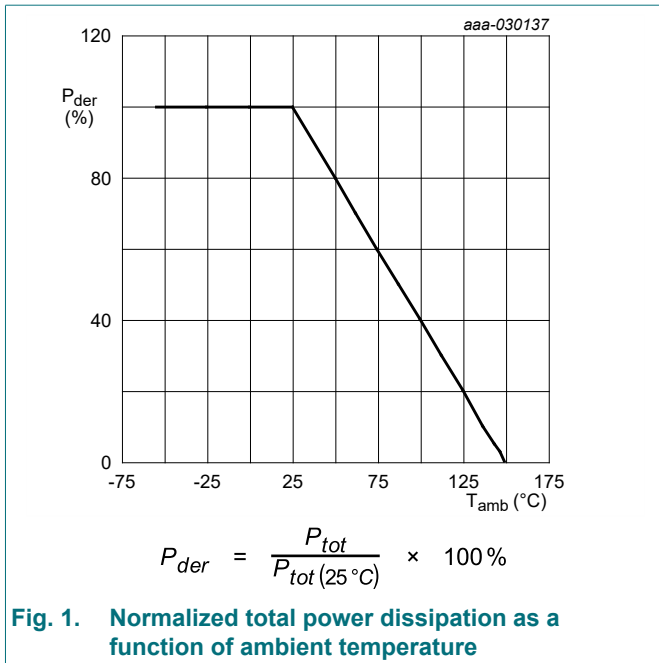
## 8. Limiting values

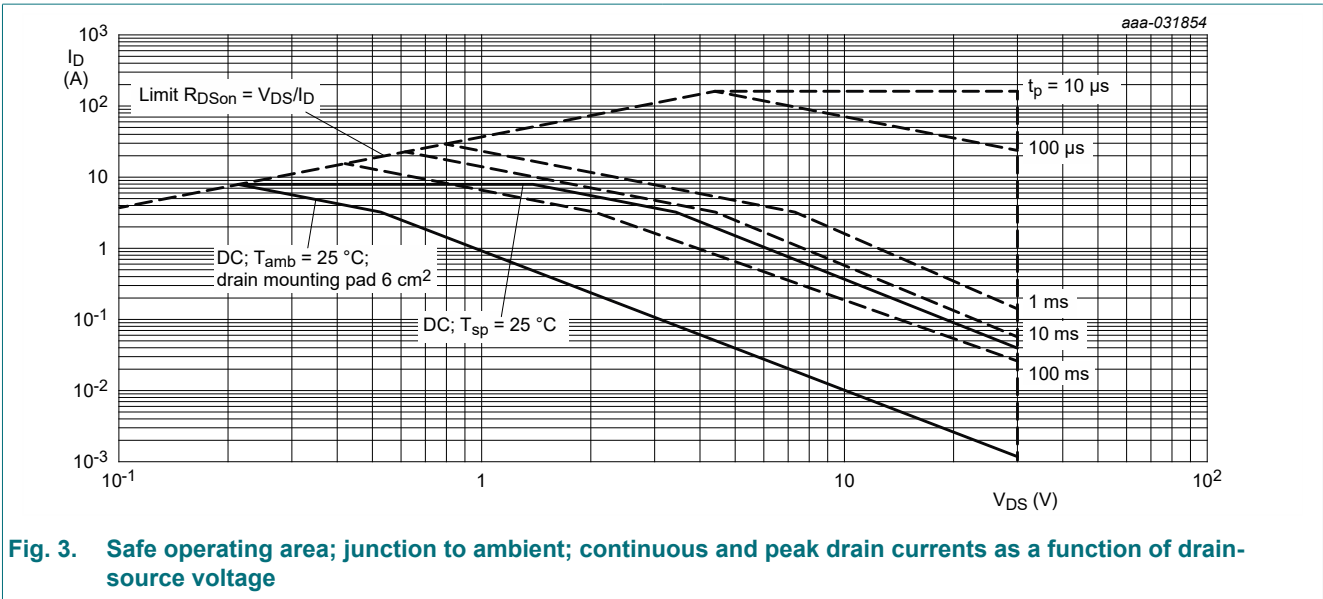
**Table 5. Limiting values**

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

| Symbol                      | Parameter                                    | Conditions  |     | Min | Max  | Unit |
|-----------------------------|--|---|-----|-----|------|------|
| V <sub>DS</sub>             | drain-source voltage                         | T <sub>j</sub> = 25 °C  |     | -   | 30   | V    |
| V <sub>GS</sub>             | gate-source voltage                          |   |     | -20 | 20   | V    |
| I <sub>D</sub>              | drain current                                | V <sub>GS</sub> = 10 V; T <sub>amb</sub> = 25 °C; t ≤ 5 s                           | [1] | -   | 12   | A    |
|                             |  | V <sub>GS</sub> = 10 V; T <sub>amb</sub> = 25 °C                                    | [1] | -   | 7.9  | A    |
|                             |  | V <sub>GS</sub> = 10 V; T <sub>amb</sub> = 100 °C                                   | [1] | -   | 5    | A    |
|                             |  | V <sub>GS</sub> = 10 V; T <sub>sp</sub> = 25 °C                                     |     | -   | 20   | A    |
| I <sub>DM</sub>             | peak drain current                           | T <sub>amb</sub> = 25 °C; single pulse; t <sub>p</sub> ≤ 10 μs                      |     | -   | 163  | A    |
| P <sub>tot</sub>            | total power dissipation                      | T <sub>amb</sub> = 25 °C; t ≤ 5 s   | [1] | -   | 3.8  | W    |
|                             |  | T <sub>amb</sub> = 25 °C  | [1] | -   | 1.7  | W    |
|                             |  | T <sub>sp</sub> = 25 °C   |     | -   | 10.9 | W    |
| T <sub>j</sub>              | junction temperature                         |   |     | -55 | 150  | °C   |
| T <sub>amb</sub>            | ambient temperature                          |   |     | -55 | 150  | °C   |
| T <sub>stg</sub>            | storage temperature                          |   |     | -65 | 150  | °C   |
| <b>Source-drain diode</b>   |  |   |     |     |      |      |
| I <sub>S</sub>              | source current                               | T <sub>amb</sub> = 25 °C  | [1] | -   | 1.6  | A    |
| <b>Avalanche ruggedness</b> |  |   |     |     |      |      |
| E <sub>DS(AL)S</sub>        | non-repetitive drain-source avalanche energy | T <sub>j(initial)</sub> = 25 °C; I <sub>D</sub> = 1 A; DUT in avalanche (unclamped) |     | -   | 15   | mJ   |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and mounting pad for drain 6 cm<sup>2</sup>.





## 9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol         | Parameter  | Conditions                |     | Min | Typ | Max  | Unit |
|----------------|--|---------------------------|-----|-----|-----|------|------|
| $R_{th(j-a)}$  | thermal resistance from junction to ambient      | in free air               | [1] | -   | 160 | 200  | K/W  |
|                |  |                           | [2] | -   | 60  | 75   | K/W  |
|                |  | in free air; $t \leq 5$ s | [2] | -   | 28  | 33   | K/W  |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |                           |     | -   | 8.3 | 11.5 | K/W  |

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 6 cm<sup>2</sup>.

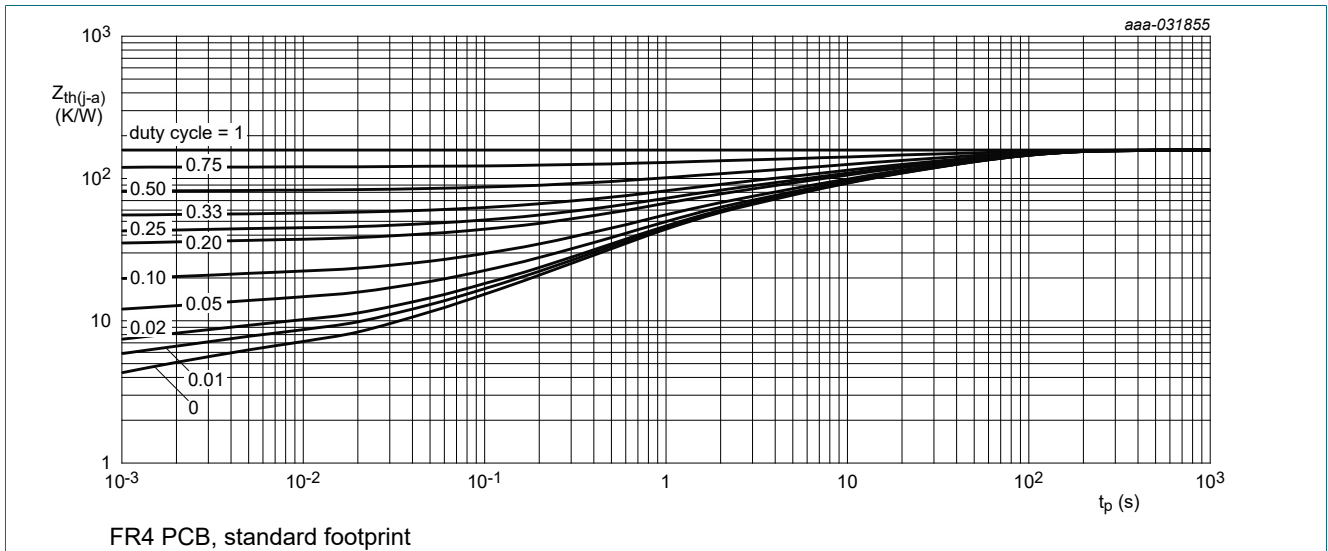


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

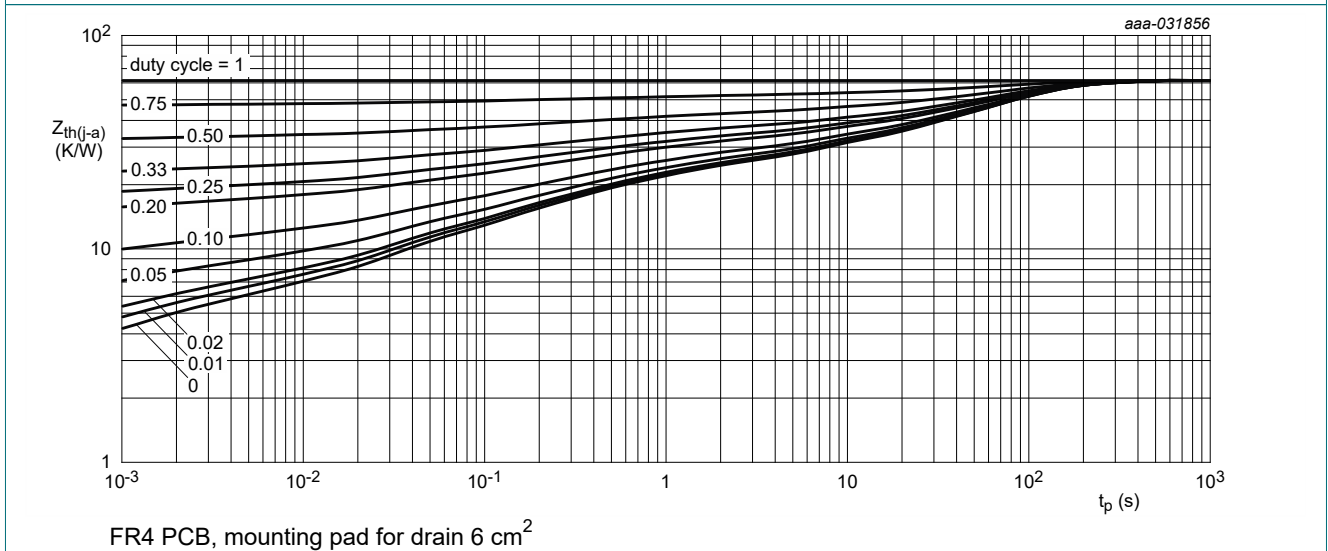


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

| Symbol                         | Parameter                         | Conditions  | Min   | Typ  | Max  | Unit       |
|--------------------------------|-----------------------------------|---|---|------|------|------------|
| <b>Static characteristics</b>  |                                   |   |   |      |      |            |
| $V_{(BR)DSS}$                  | drain-source breakdown voltage    | $I_D = 250 \mu A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$  | 30  | -    | -    | V          |
| $V_{GSth}$                     | gate-source threshold voltage     | $I_D = 250 \mu A$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 \text{ }^\circ C$   | 1.2   | 1.7  | 2.2  | V          |
| $I_{DSS}$                      | drain leakage current             | $V_{DS} = 30 V$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$  | -   | -    | 1    | $\mu A$    |
| $I_{GSS}$                      | gate leakage current              | $V_{GS} = 20 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$  | -   | -    | 100  | nA         |
|                                |                                   | $V_{GS} = -20 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$   | -   | -    | -100 | nA         |
| $R_{DSon}$                     | drain-source on-state resistance  | $V_{GS} = 10 V$ ; $I_D = 7.9 A$ ; $T_j = 25 \text{ }^\circ C$   | -   | 14.8 | 17.4 | m $\Omega$ |
|                                |                                   | $V_{GS} = 10 V$ ; $I_D = 7.9 A$ ; $T_j = 150 \text{ }^\circ C$  | -   | 22.9 | 27   | m $\Omega$ |
|                                |                                   | $V_{GS} = 4.5 V$ ; $I_D = 6.8 A$ ; $T_j = 25 \text{ }^\circ C$  | -   | 18.5 | 23.1 | m $\Omega$ |
| $g_{fs}$                       | forward transconductance          | $V_{DS} = 10 V$ ; $I_D = 7.9 A$ ; $T_j = 25 \text{ }^\circ C$   | -   | 15   | -    | S          |
| $R_G$                          | gate resistance                   | $f = 1 \text{ MHz}$   | -   | 3    | -    | $\Omega$   |
| <b>Dynamic characteristics</b> |                                   |   |   |      |      |            |
| $Q_{G(tot)}$                   | total gate charge                 | $V_{DS} = 15 V$ ; $I_D = 7.9 A$ ; $V_{GS} = 10 V$ ; $T_j = 25 \text{ }^\circ C$                             | -   | 5.1  | 7.7  | nC         |
|                                |                                   | $V_{DS} = 15 V$ ; $I_D = 6.8 A$ ; $V_{GS} = 4.5 V$ ; $T_j = 25 \text{ }^\circ C$                            | -   | 2.5  | 3.8  | nC         |
| $Q_{GS}$                       | gate-source charge                | $T_j = 25 \text{ }^\circ C$   | -   | 0.9  | -    | nC         |
| $Q_{GS(th)}$                   | pre-threshold gate-source charge  |   | -   | 0.5  | -    | nC         |
| $Q_{GS(th-pl)}$                | post-threshold gate-source charge |   | -   | 0.4  | -    | nC         |
| $Q_{GD}$                       | gate-drain charge                 |   | -   | 0.7  | -    | nC         |
| $V_{GSpl}$                     | gate-source plateau voltage       |   | $V_{DS} = 15 V$ ; $I_D = 6.8 A$ ; $T_j = 25 \text{ }^\circ C$ | -    | 2.5  | -          |
| $C_{iss}$                      | input capacitance                 | $V_{DS} = 15 V$ ; $f = 1 \text{ MHz}$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$                        | -   | 350  | -    | pF         |
| $C_{oss}$                      | output capacitance                |   | -   | 186  | -    | pF         |
| $C_{rss}$                      | reverse transfer capacitance      |   | -   | 21   | -    | pF         |
| $t_{d(on)}$                    | turn-on delay time                | $V_{DS} = 15 V$ ; $I_D = 6.8 A$ ; $V_{GS} = 4.5 V$ ; $R_{G(ext)} = 5 \Omega$ ; $T_j = 25 \text{ }^\circ C$  | -   | 5    | -    | ns         |
| $t_r$                          | rise time                         |   | -   | 8    | -    | ns         |
| $t_{d(off)}$                   | turn-off delay time               |   | -   | 6    | -    | ns         |
| $t_f$                          | fall time                         |   | -   | 3    | -    | ns         |
| <b>Source-drain diode</b>      |                                   |   |   |      |      |            |
| $V_{SD}$                       | source-drain voltage              | $I_S = 1.6 A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$  | -   | 0.7  | 1.2  | V          |
| $t_{rr}$                       | reverse recovery time             | $I_S = 1.6 A$ ; $di_S/dt = -100 A/\mu s$ ; $V_{GS} = 4.5 V$ ; $V_{DS} = 15 V$ ; $T_j = 25 \text{ }^\circ C$ | -   | 15   | -    | ns         |
| $Q_r$                          | recovered charge                  |   | -   | 6    | -    | nC         |
| $t_a$                          | reverse recovery rise time        |   | -   | 8    | -    | ns         |
| $t_b$                          | reverse recovery fall time        |   | -   | 7    | -    | ns         |

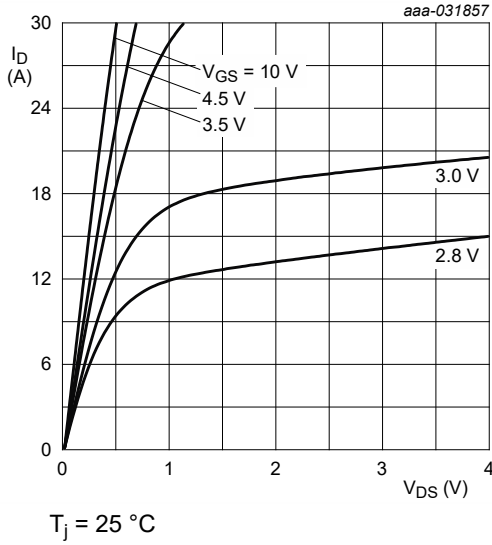


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

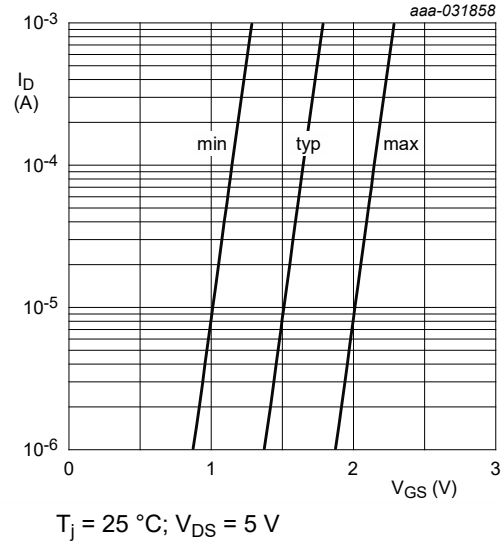


Fig. 7. Subthreshold drain current as a function of gate-source voltage

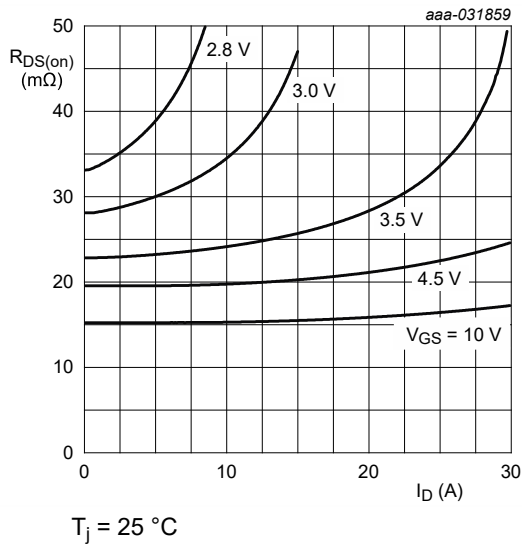


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

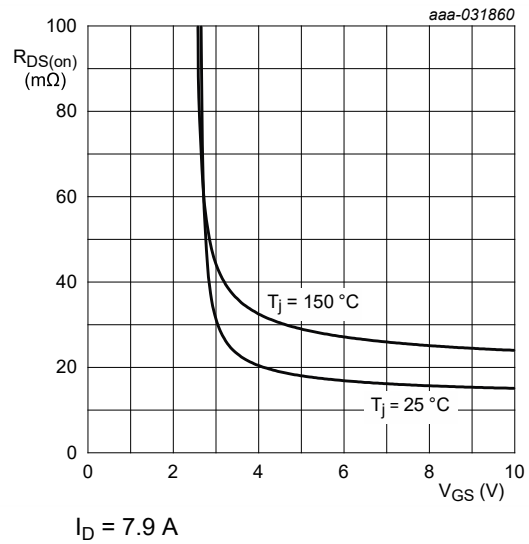


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

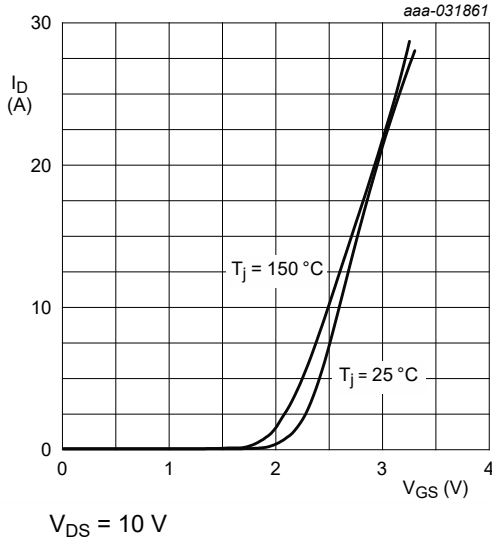


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

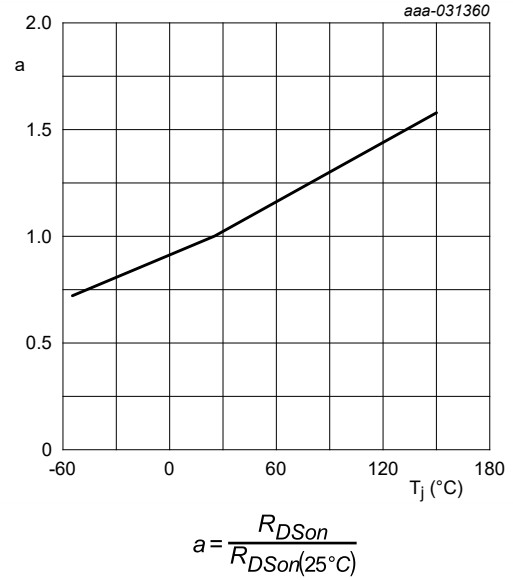


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

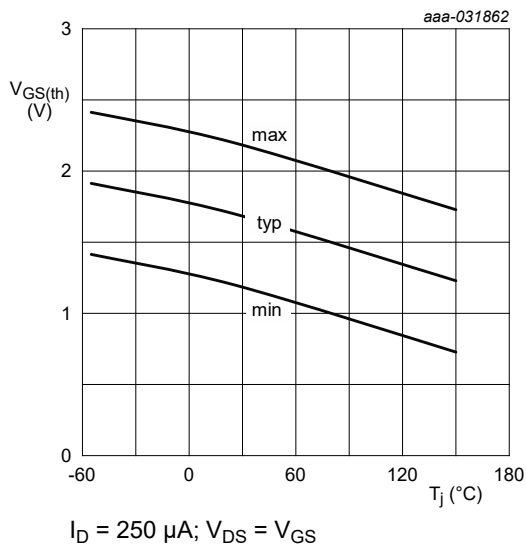


Fig. 12. Gate-source threshold voltage as a function of junction temperature

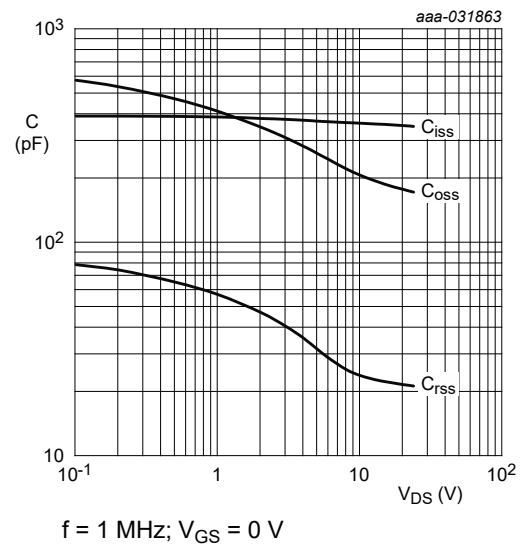
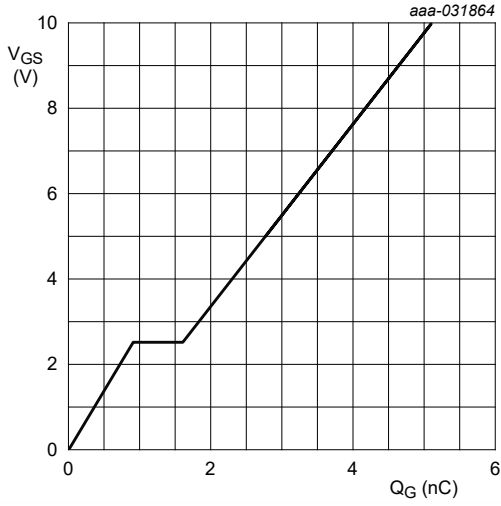


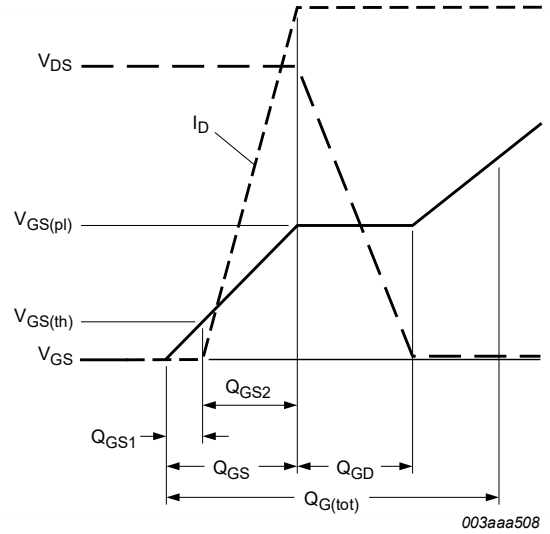
Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values





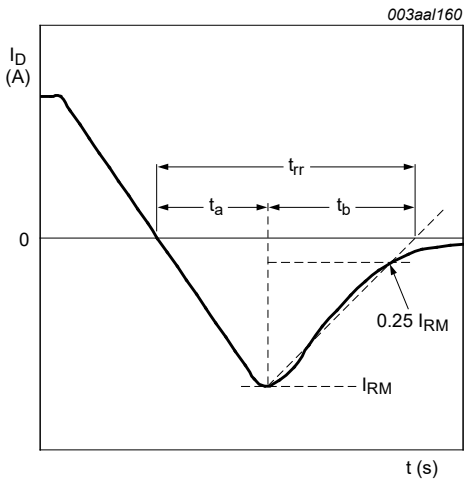
$I_D = 6.8 \text{ A}; V_{DS} = 15 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$

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



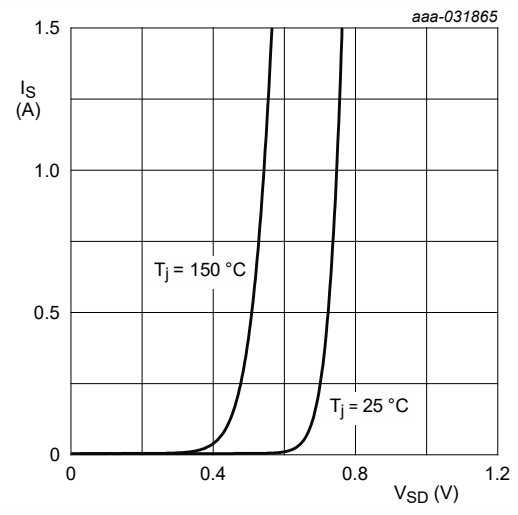
003aaa508

**Fig. 15. Gate charge waveform definitions**



003aal160

**Fig. 16. Reverse recovery timing definition**



aaa-031865

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

**Fig. 17. Source current as a function of source-drain voltage; typical values**

## 11. Test information

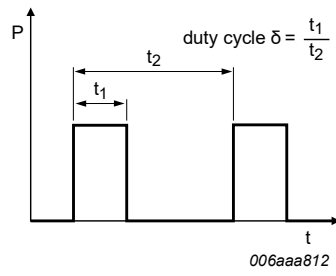
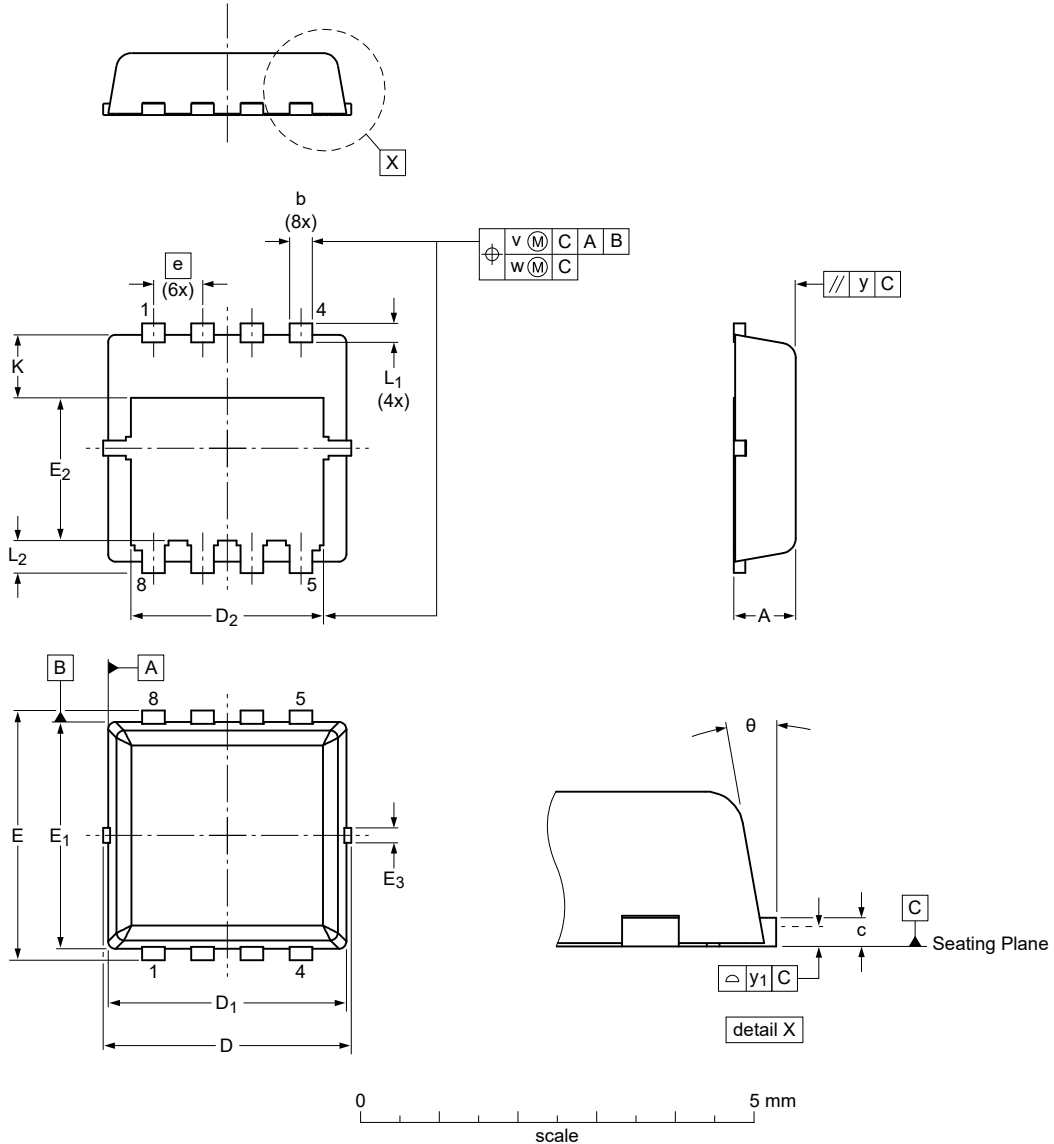


Fig. 18. Duty cycle definition

12. Package outline

MLPAK33: plastic thermal enhanced surface mounted package; mini leads; 8 terminals;  
pitch 0.65 mm; 3.3 x 3.3 x 0.8 mm body

SOT8002-1



Dimensions (mm are the original dimensions)

| Unit   | A    | b    | c    | D    | D <sub>1</sub> | D <sub>2</sub> | e    | E    | E <sub>1</sub> | E <sub>2</sub> | E <sub>3</sub> | K          | L <sub>1</sub> | L <sub>2</sub> | θ   | y    | y <sub>1</sub> | v   | w    |
|--------|------|------|------|------|----------------|----------------|------|------|----------------|----------------|----------------|------------|----------------|----------------|-----|------|----------------|-----|------|
| max    | 0.90 | 0.35 | 0.18 | 3.50 | 3.25           | 2.65           |      | 3.50 | 3.10           | 1.99           | 0.25           |            | 0.40           | 0.58           | 12° |      |                |     |      |
| mm nom | 0.80 | 0.30 | 0.15 | 3.30 | 3.15           | 2.55           | 0.65 | 3.30 | 3.00           | 1.89           | 0.20           | 0.65 (ref) | 0.25           | 0.43           | 10° | 0.05 | 0.05           | 0.1 | 0.05 |
| min    | 0.70 | 0.25 | 0.12 | 3.10 | 3.05           | 2.45           |      | 3.10 | 2.90           | 1.79           | 0.15           |            | 0.10           | 0.28           | 8°  |      |                |     |      |

sot8002-1\_po

| Outline version | References |       |      |  | European projection | Issue date           |
|-----------------|------------|-------|------|--|---------------------|----------------------|
|                 | IEC        | JEDEC | EIAJ |  |                     |                      |
| SOT8002-1       |            |       |      |  |                     | 19-12-19<br>20-01-09 |

Fig. 19. Package outline MLPAK33 (SOT8002-1)

### 13. Soldering

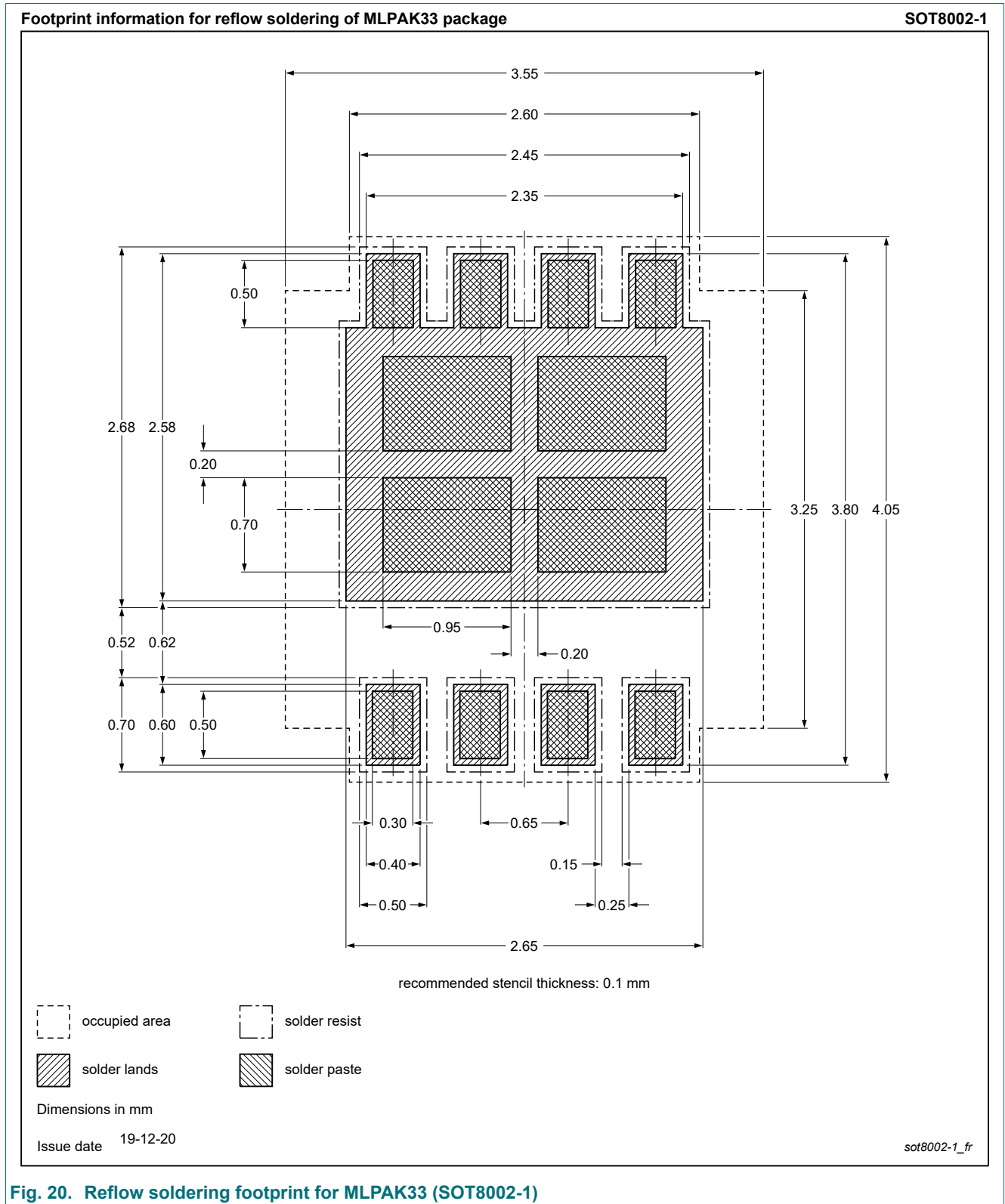


Fig. 20. Reflow soldering footprint for MLPAK33 (SOT8002-1)

## 14. Revision history

Table 8. Revision history

| Data sheet ID   | Release date | Data sheet status  | Change notice | Supersedes |
|-----------------|--------------|--------------------|---------------|------------|
| PXN017-30QL v.1 | 20201102     | Product data sheet | -             | -          |

## 15. 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.                                     |

- [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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