



# BUK7M15-40H

N-channel 40 V, 15.0 mΩ standard level MOSFET in LPAK33

10 January 2025

Product data sheet

## 1. General description

Automotive qualified standard level N-channel MOSFET in an LPAK33 package using Trench 9 TrenchMOS technology. This product has been designed and qualified to AEC-Q101 for use in high performance automotive applications.

## 2. Features and benefits

- Fully automotive qualified to AEC-Q101 at 175 °C
- Trench 9 superjunction technology:
  - Low power losses, high power density
- LPAK copper clip package technology:
  - High robustness and reliability
  - Gull wing leads for high manufacturability and AOI
- Repetitive avalanche rated

## 3. Applications

- 12 V automotive systems
- Powertrain, chassis, body and infotainment applications
- Medium/Low power motor drive
- DC-DC systems
- LED lighting

## 4. Quick reference data

Table 1. Quick reference data

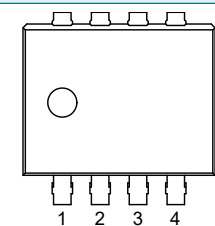
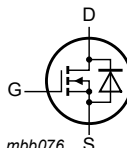
| Symbol                         | Parameter                        | Conditions                                                                                                                |     | Min | Typ  | Max | Unit |
|--------------------------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------|-----|-----|------|-----|------|
| $V_{DS}$                       | drain-source voltage             | $25\text{ °C} \leq T_j \leq 175\text{ °C}$                                                                                |     | -   | -    | 40  | V    |
| $I_D$                          | drain current                    | $V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 2</a>                                                 | [1] | -   | -    | 30  | A    |
| $P_{tot}$                      | total power dissipation          | $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 1</a>                                                                          |     | -   | -    | 44  | W    |
| <b>Static characteristics</b>  |                                  |                                                                                                                           |     |     |      |     |      |
| $R_{DS(on)}$                   | drain-source on-state resistance | $V_{GS} = 10\text{ V}$ ; $I_D = 10\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 11</a>                             |     | 8.5 | 12.2 | 15  | mΩ   |
| <b>Dynamic characteristics</b> |                                  |                                                                                                                           |     |     |      |     |      |
| $Q_{GD}$                       | gate-drain charge                | $I_D = 10\text{ A}$ ; $V_{DS} = 32\text{ V}$ ; $V_{GS} = 10\text{ V}$ ; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a> |     | -   | 1.7  | 3.4 | nC   |
| <b>Source-drain diode</b>      |                                  |                                                                                                                           |     |     |      |     |      |
| $Q_r$                          | recovered charge                 | $I_S = 10\text{ A}$ ; $dI_S/dt = -100\text{ A/}\mu\text{s}$ ; $V_{GS} = 0\text{ V}$ ; $V_{DS} = 20\text{ V}$              |     | -   | 11   | -   | nC   |

| Symbol | Parameter       | Conditions                                                                                                                                      | Min | Typ  | Max | Unit |
|--------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|-----|------|
| S      | softness factor | $I_S = 10\text{ A}$ ; $dI_S/dt = -100\text{ A}/\mu\text{s}$ ; $V_{GS} = 0\text{ V}$ ; $V_{DS} = 20\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ | -   | 0.56 | -   |      |

[1] 30A 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                            | <br>LPAK33 (SOT1210) | <br>mbb076 |
| 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                 |
| <a href="#">BUK7M15-40H</a> | LPAK33  | Plastic, single ended surface mounted package (LPAK33); 8 leads; 0.65 mm pitch | <a href="#">SOT1210</a> |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| BUK7M15-40H | 71540H       |

8. Limiting values

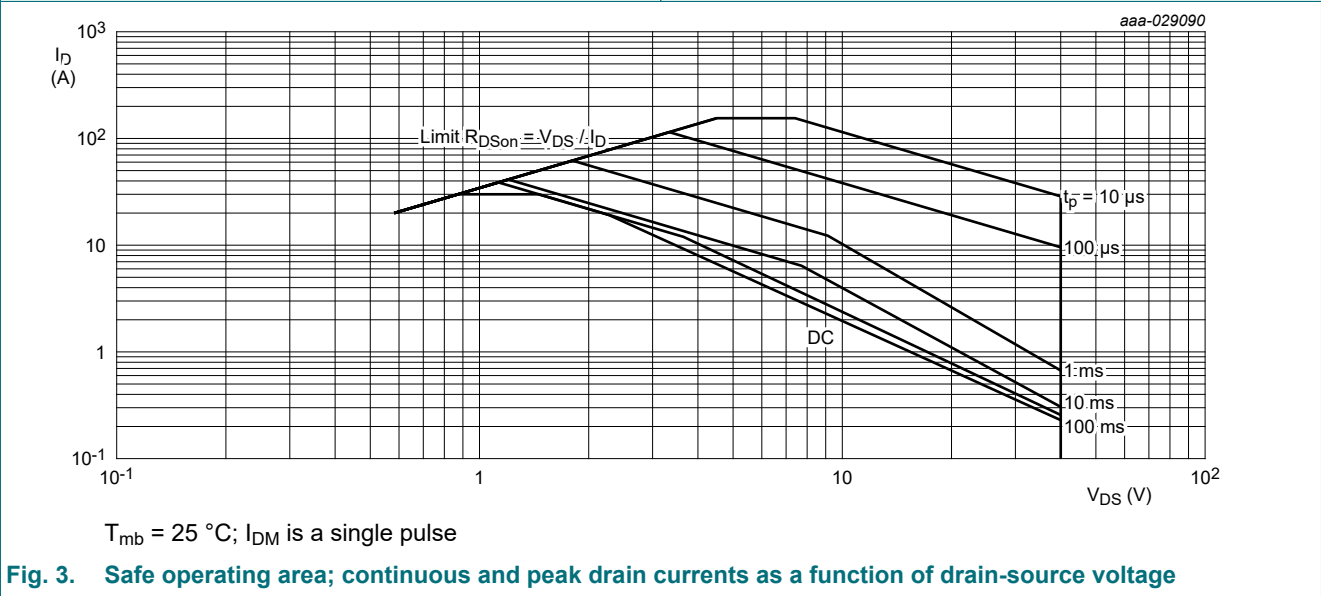
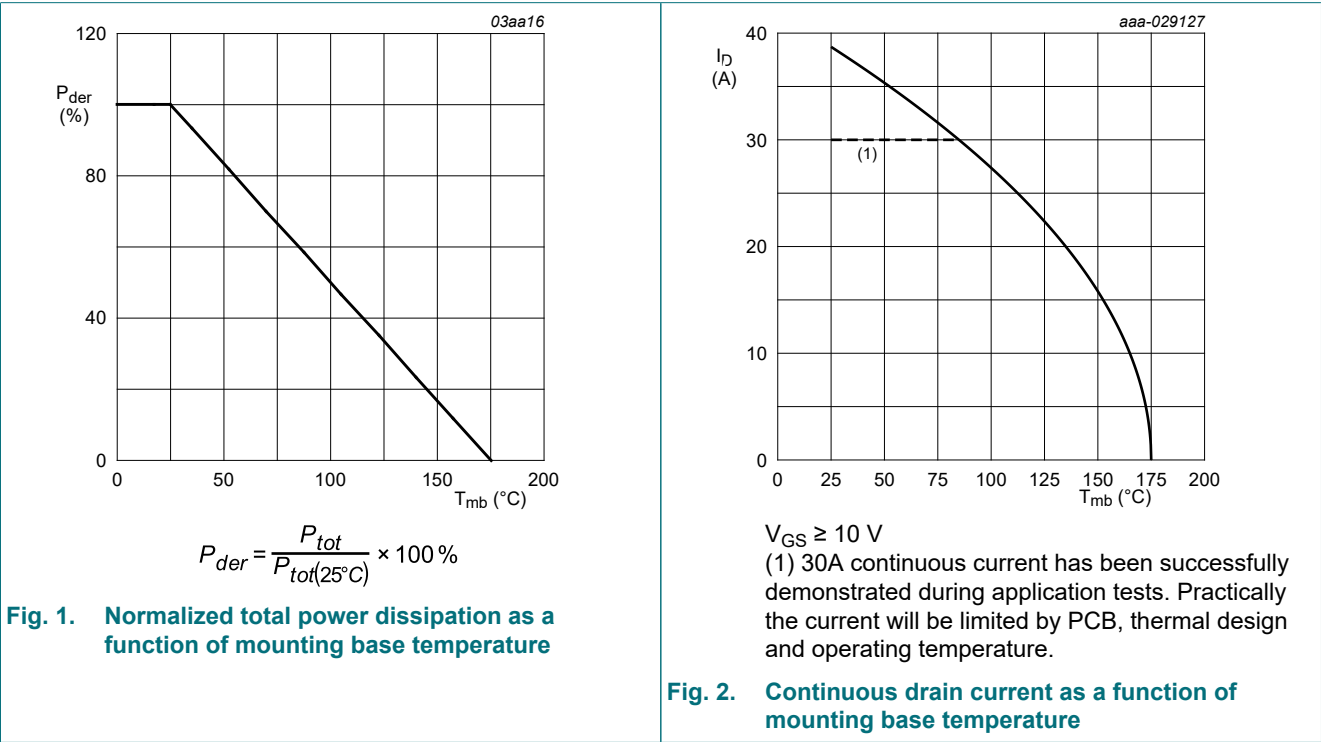
Table 5. Limiting values

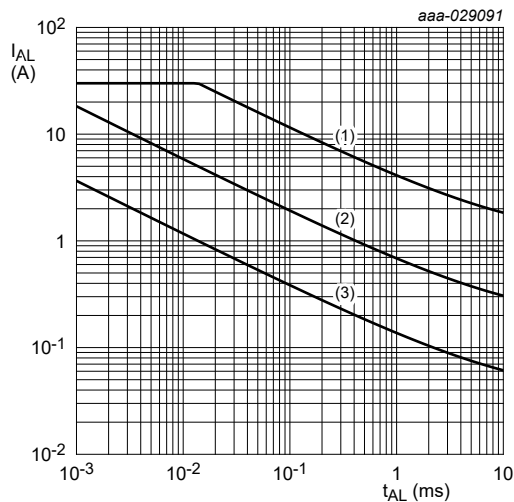
In accordance with the Absolute Maximum Rating System (IEC 60134).  $T_j = 25\text{ }^\circ\text{C}$  unless otherwise stated.

| Symbol    | Parameter               | Conditions                                                                                              | Min     | Max  | Unit             |
|-----------|-------------------------|---------------------------------------------------------------------------------------------------------|---------|------|------------------|
| $V_{DS}$  | drain-source voltage    | $25\text{ }^\circ\text{C} \leq T_j \leq 175\text{ }^\circ\text{C}$                                      | -       | 40   | V                |
| $V_{GS}$  | gate-source voltage     |                                                                                                         | [1] -20 | 20   | V                |
| $P_{tot}$ | total power dissipation | $T_{mb} = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 1</a>                                            | -       | 44   | W                |
| $I_D$     | drain current           | $V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 2</a>                   | [2] -   | 30   | A                |
|           |                         | $V_{GS} = 10\text{ V}$ ; $T_{mb} = 100\text{ }^\circ\text{C}$ ; <a href="#">Fig. 2</a>                  | -       | 27.4 | A                |
| $I_{DM}$  | peak drain current      | pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 3</a> | -       | 155  | A                |
| $T_{stg}$ | storage temperature     |                                                                                                         | -55     | 175  | $^\circ\text{C}$ |
| $T_j$     | junction temperature    |                                                                                                         | -55     | 175  | $^\circ\text{C}$ |

| Symbol               | Parameter                                    | Conditions                                                                                                                                      |         | Min | Max  | Unit |
|----------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----|------|------|
| Source-drain diode   |                                              |                                                                                                                                                 |         |     |      |      |
| I <sub>S</sub>       | source current                               | T <sub>mb</sub> = 25 °C                                                                                                                         |         | -   | 30   | A    |
| I <sub>SM</sub>      | peak source current                          | pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C                                                                                         |         | -   | 155  | A    |
| Avalanche ruggedness |                                              |                                                                                                                                                 |         |     |      |      |
| E <sub>DS(AL)S</sub> | non-repetitive drain-source avalanche energy | I <sub>D</sub> = 30 A; V <sub>sup</sub> ≤ 40 V; R <sub>GS</sub> = 50 Ω; V <sub>GS</sub> = 10 V; T <sub>j(init)</sub> = 25 °C; unclamped; Fig. 4 | [3] [4] | -   | 10.7 | mJ   |

- [1] Refer to application note AN90001 for further information.
- [2] 30A continuous current has been successfully demonstrated during application tests. Practically the current will be limited by PCB, thermal design and operating temperature.
- [3] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.
- [4] Refer to application note AN10273 for further information.





(1)  $T_{j\text{ (init)}} = 25\text{ °C}$ ; (2)  $T_{j\text{ (init)}} = 150\text{ °C}$ ; (3) Repetitive Avalanche

Fig. 4. Avalanche rating; avalanche current as a function of avalanche time

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     | -   | 3.22 | 3.44 | K/W  |

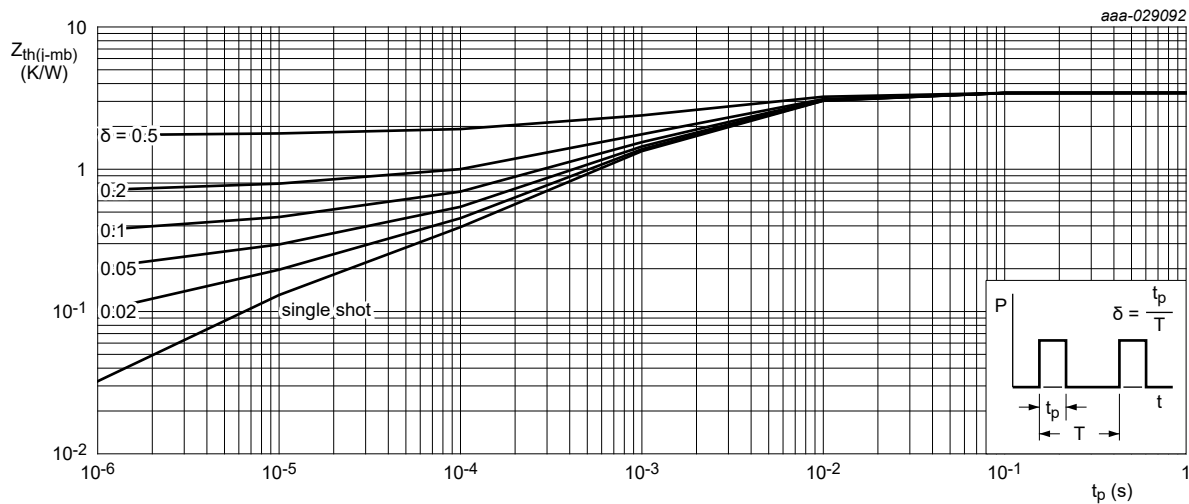


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 10. Characteristics

Table 7. Characteristics

| Symbol                  | Parameter                        | Conditions                                                                                                                         |  | Min  | Typ  | Max  | Unit |
|-------------------------|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------|--|------|------|------|------|
| Static characteristics  |                                  |                                                                                                                                    |  |      |      |      |      |
| V <sub>(BR)DSS</sub>    | drain-source breakdown voltage   | I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 25 °C                                                             |  | 40   | 43   | -    | V    |
|                         |                                  | I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>J</sub> = -40 °C                                                            |  | -    | 40.5 | -    | V    |
|                         |                                  | I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>J</sub> = -55 °C                                                            |  | 36   | 40   | -    | V    |
| V <sub>GS(th)</sub>     | gate-source threshold voltage    | I <sub>D</sub> = 1 mA; V <sub>DS</sub> =V <sub>GS</sub> ; T <sub>J</sub> = 25 °C; <a href="#">Fig. 9</a> ; <a href="#">Fig. 10</a> |  | 2.4  | 3    | 3.6  | V    |
|                         |                                  | I <sub>D</sub> = 1 mA; V <sub>DS</sub> =V <sub>GS</sub> ; T <sub>J</sub> = -55 °C; <a href="#">Fig. 10</a>                         |  | -    | -    | 4.3  | V    |
|                         |                                  | I <sub>D</sub> = 1 mA; V <sub>DS</sub> =V <sub>GS</sub> ; T <sub>J</sub> = 175 °C; <a href="#">Fig. 10</a>                         |  | 1    | -    | -    | V    |
| I <sub>DSS</sub>        | drain leakage current            | V <sub>DS</sub> = 40 V; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 25 °C                                                              |  | -    | 0.01 | 1    | μA   |
|                         |                                  | V <sub>DS</sub> = 16 V; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 125 °C                                                             |  | -    | 0.24 | 10   | μA   |
|                         |                                  | V <sub>DS</sub> = 40 V; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 175 °C                                                             |  | -    | 19   | 500  | μA   |
| I <sub>GSS</sub>        | gate leakage current             | V <sub>GS</sub> = 20 V; V <sub>DS</sub> = 0 V; T <sub>J</sub> = 25 °C                                                              |  | -    | 2    | 100  | nA   |
|                         |                                  | V <sub>GS</sub> = -16 V; V <sub>DS</sub> = 0 V; T <sub>J</sub> = 25 °C                                                             |  | -    | 2    | 100  | nA   |
| R <sub>DSon</sub>       | drain-source on-state resistance | V <sub>GS</sub> = 10 V; I <sub>D</sub> = 10 A; T <sub>J</sub> = 25 °C; <a href="#">Fig. 11</a>                                     |  | 8.5  | 12.2 | 15   | mΩ   |
|                         |                                  | V <sub>GS</sub> = 10 V; I <sub>D</sub> = 10 A; T <sub>J</sub> = 105 °C; <a href="#">Fig. 12</a>                                    |  | 11.6 | 17.6 | 22.5 | mΩ   |
|                         |                                  | V <sub>GS</sub> = 10 V; I <sub>D</sub> = 10 A; T <sub>J</sub> = 125 °C; <a href="#">Fig. 12</a>                                    |  | 12.8 | 19   | 24.2 | mΩ   |
|                         |                                  | V <sub>GS</sub> = 10 V; I <sub>D</sub> = 10 A; T <sub>J</sub> = 175 °C; <a href="#">Fig. 12</a>                                    |  | 15.5 | 23   | 29.1 | mΩ   |
| R <sub>G</sub>          | gate resistance                  | f = 1 MHz; T <sub>J</sub> = 25 °C                                                                                                  |  | 0.3  | 0.9  | 2.3  | Ω    |
| Dynamic characteristics |                                  |                                                                                                                                    |  |      |      |      |      |
| Q <sub>G(tot)</sub>     | total gate charge                | I <sub>D</sub> = 10 A; V <sub>DS</sub> = 32 V; V <sub>GS</sub> = 10 V; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>           |  | -    | 9.1  | 12.7 | nC   |
| Q <sub>GS</sub>         | gate-source charge               |                                                                                                                                    |  | -    | 2.8  | 4.2  | nC   |
| Q <sub>GD</sub>         | gate-drain charge                |                                                                                                                                    |  | -    | 1.7  | 3.4  | nC   |
| C <sub>iss</sub>        | input capacitance                | V <sub>DS</sub> = 25 V; V <sub>GS</sub> = 0 V; f = 1 MHz; T <sub>J</sub> = 25 °C; <a href="#">Fig. 15</a>                          |  | -    | 572  | 801  | pF   |
| C <sub>oss</sub>        | output capacitance               |                                                                                                                                    |  | -    | 251  | 351  | pF   |
| C <sub>rss</sub>        | reverse transfer capacitance     |                                                                                                                                    |  | -    | 28   | 62   | pF   |
| t <sub>d(on)</sub>      | turn-on delay time               | V <sub>DS</sub> = 30 V; R <sub>L</sub> = 3 Ω; V <sub>GS</sub> = 10 V; R <sub>G(ext)</sub> = 5 Ω                                    |  | -    | 3.9  | -    | ns   |
| t <sub>r</sub>          | rise time                        |                                                                                                                                    |  | -    | 2    | -    | ns   |
| t <sub>d(off)</sub>     | turn-off delay time              |                                                                                                                                    |  | -    | 7.2  | -    | ns   |
| t <sub>f</sub>          | fall time                        |                                                                                                                                    |  | -    | 3.2  | -    | ns   |
| Source-drain diode      |                                  |                                                                                                                                    |  |      |      |      |      |
| V <sub>SD</sub>         | source-drain voltage             | I <sub>S</sub> = 10 A; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 25 °C; <a href="#">Fig. 16</a>                                      |  | -    | 0.85 | 1.2  | V    |
| t <sub>rr</sub>         | reverse recovery time            | I <sub>S</sub> = 10 A; dI <sub>S</sub> /dt = -100 A/μs; V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 20 V                              |  | -    | 19   | -    | ns   |
| Q <sub>r</sub>          | recovered charge                 |                                                                                                                                    |  | -    | 11   | -    | nC   |
| S                       | softness factor                  | I <sub>S</sub> = 10 A; dI <sub>S</sub> /dt = -100 A/μs; V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 20 V; T <sub>J</sub> = 25 °C      |  | -    | 0.56 | -    |      |
|                         |                                  | I <sub>S</sub> = 10 A; dI <sub>S</sub> /dt = -500 A/μs; V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 20 V; T <sub>J</sub> = 25 °C      |  | -    | 0.37 | -    |      |

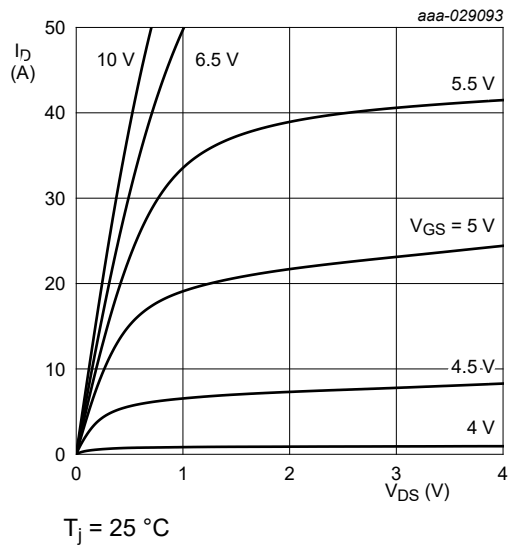


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

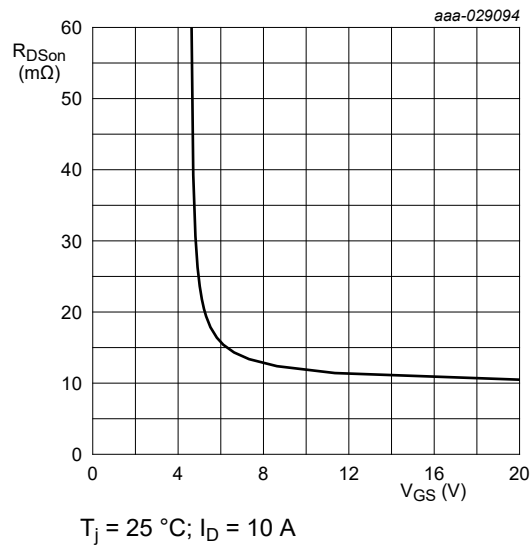


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

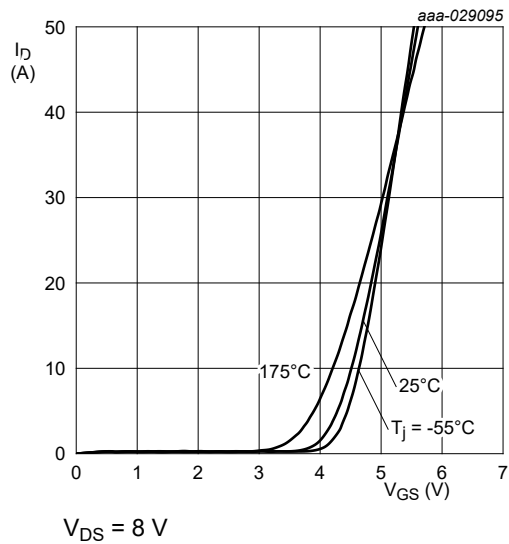


Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values

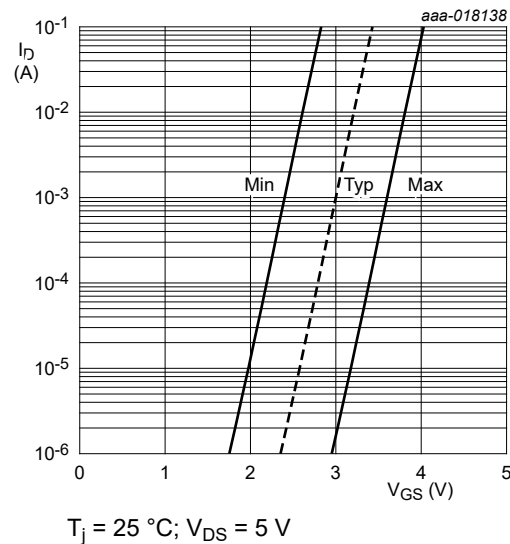


Fig. 9. Sub-threshold drain current as a function of gate-source voltage

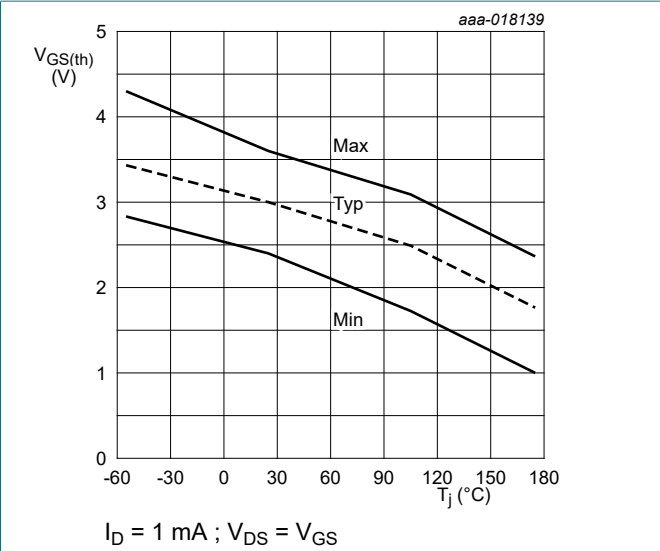


Fig. 10. Gate-source threshold voltage as a function of junction temperature

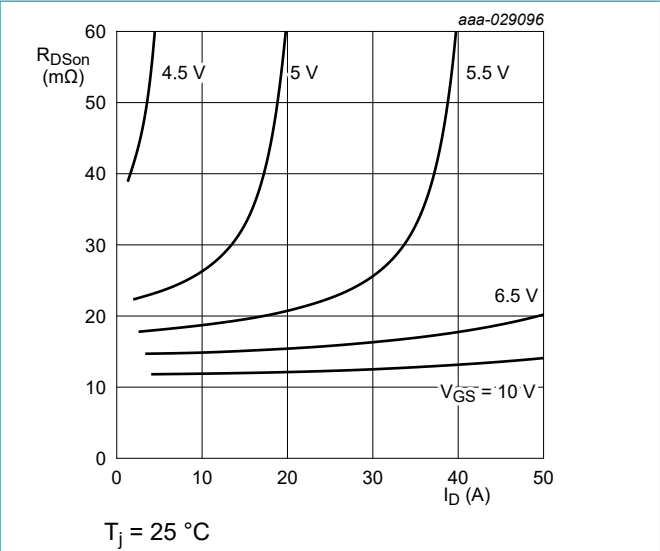


Fig. 11. Drain-source on-state resistance as a function of drain current; typical values

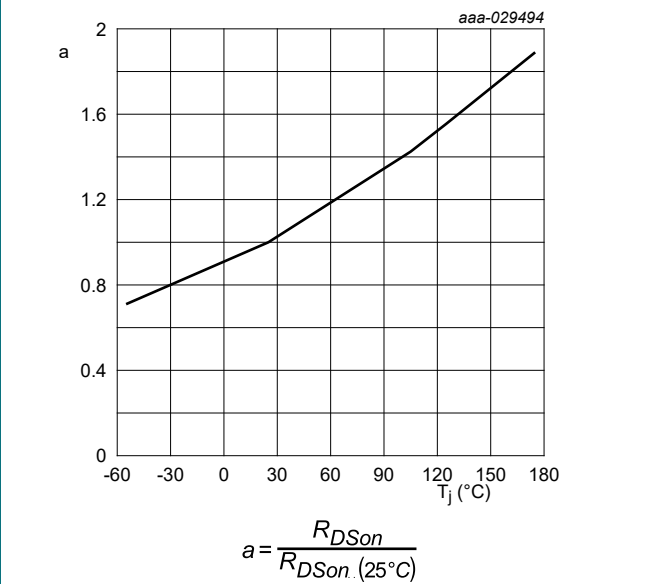


Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

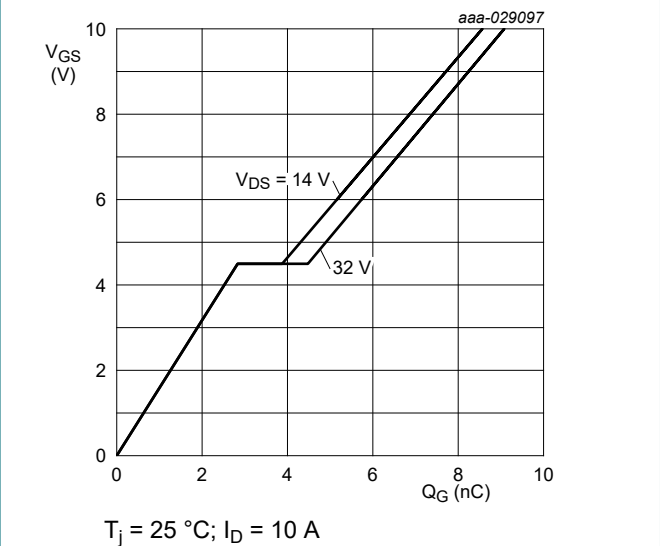


Fig. 13. Gate-source voltage as a function of gate charge; typical values

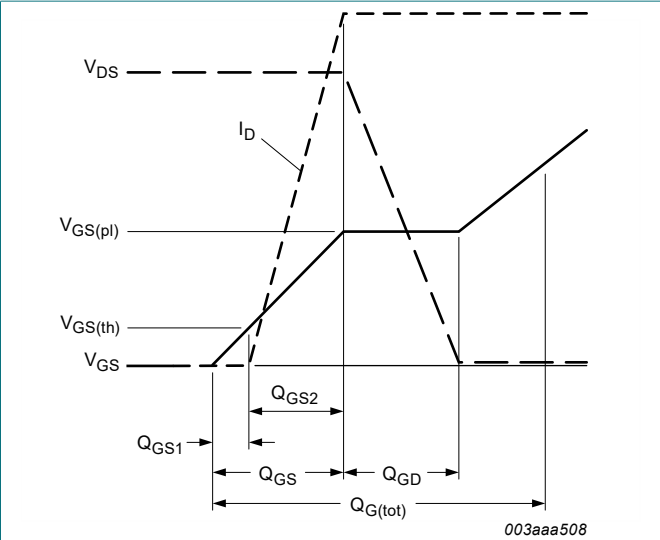


Fig. 14. Gate charge waveform definitions

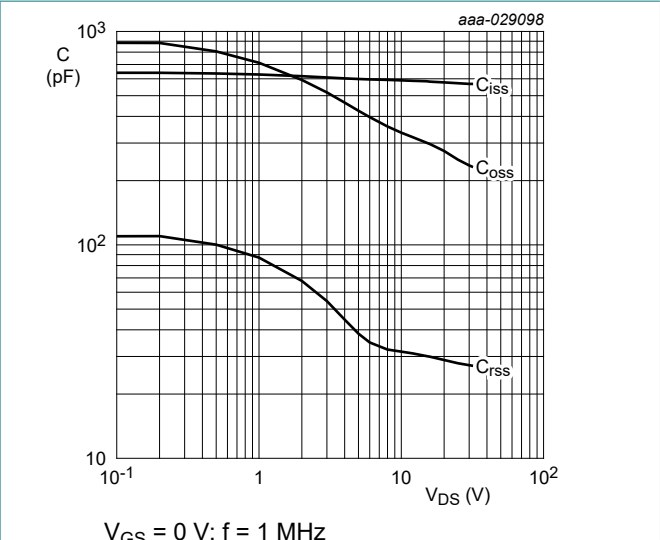


Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

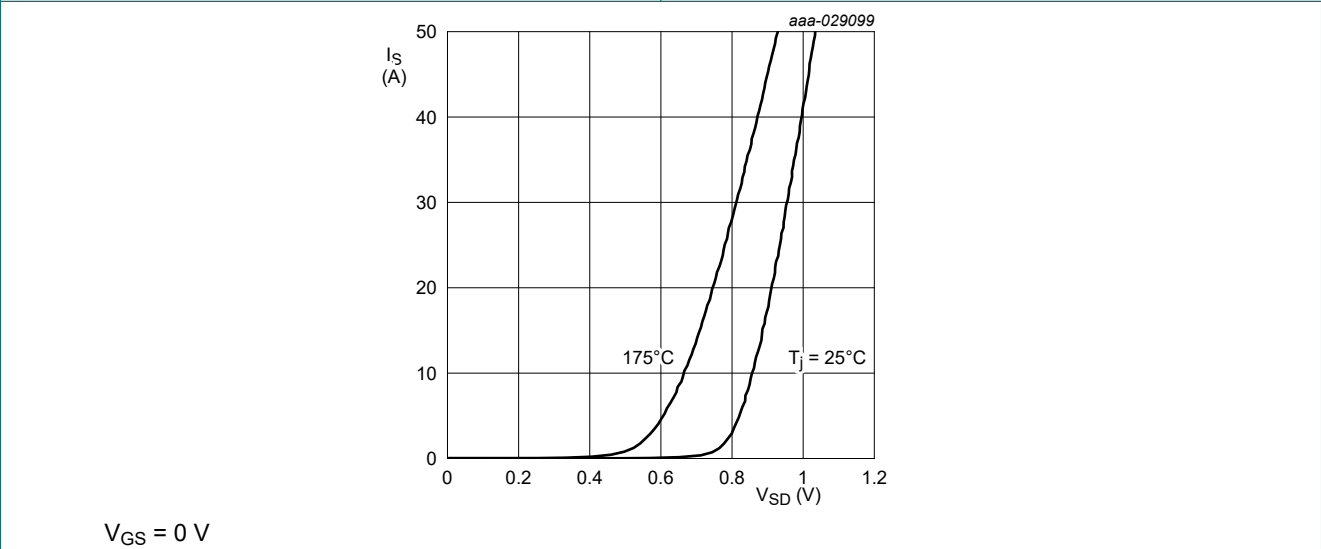


Fig. 16. Source-drain (diode forward) current as a function of source-drain (diode forward) voltage; typical values



11. Package outline

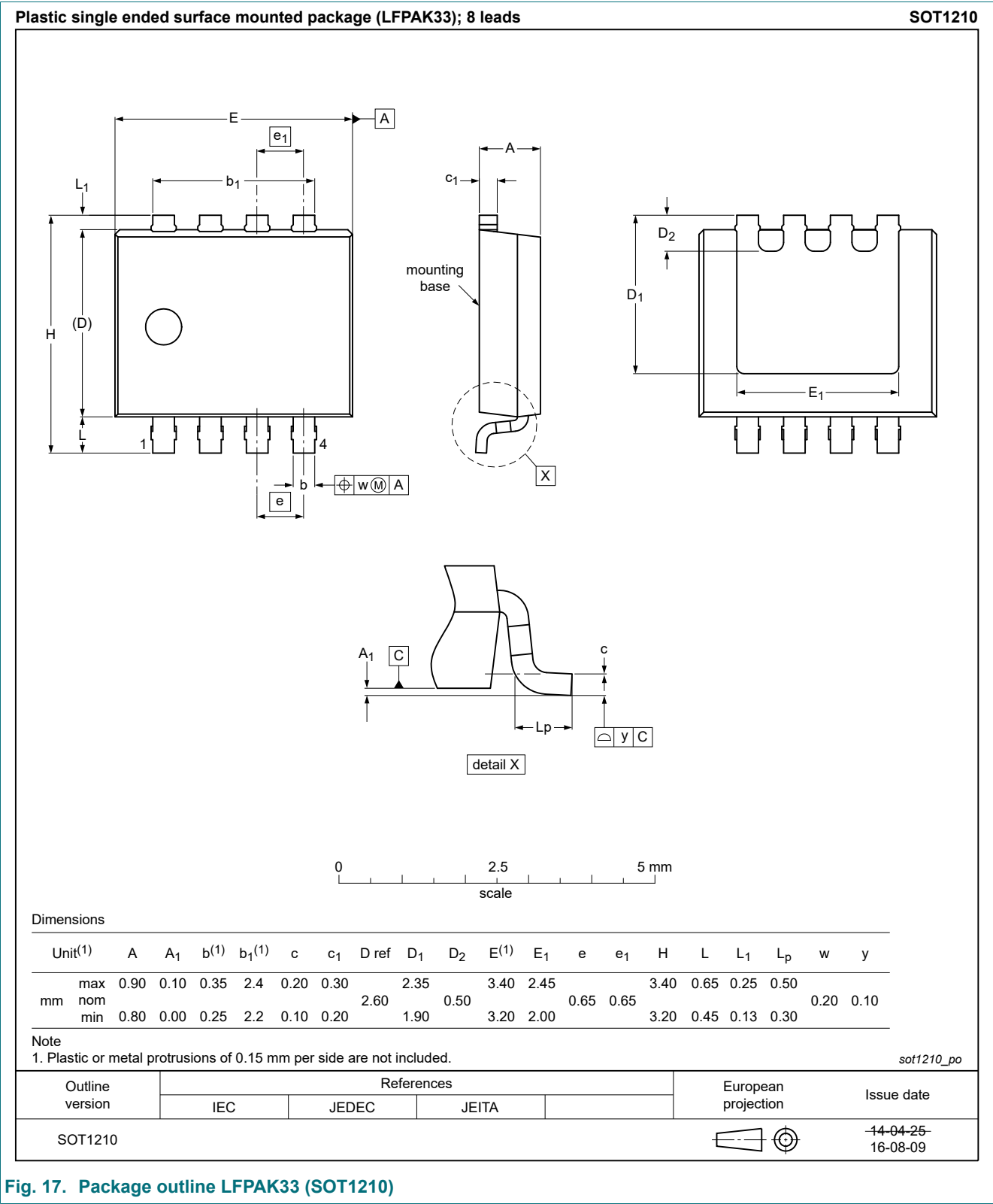
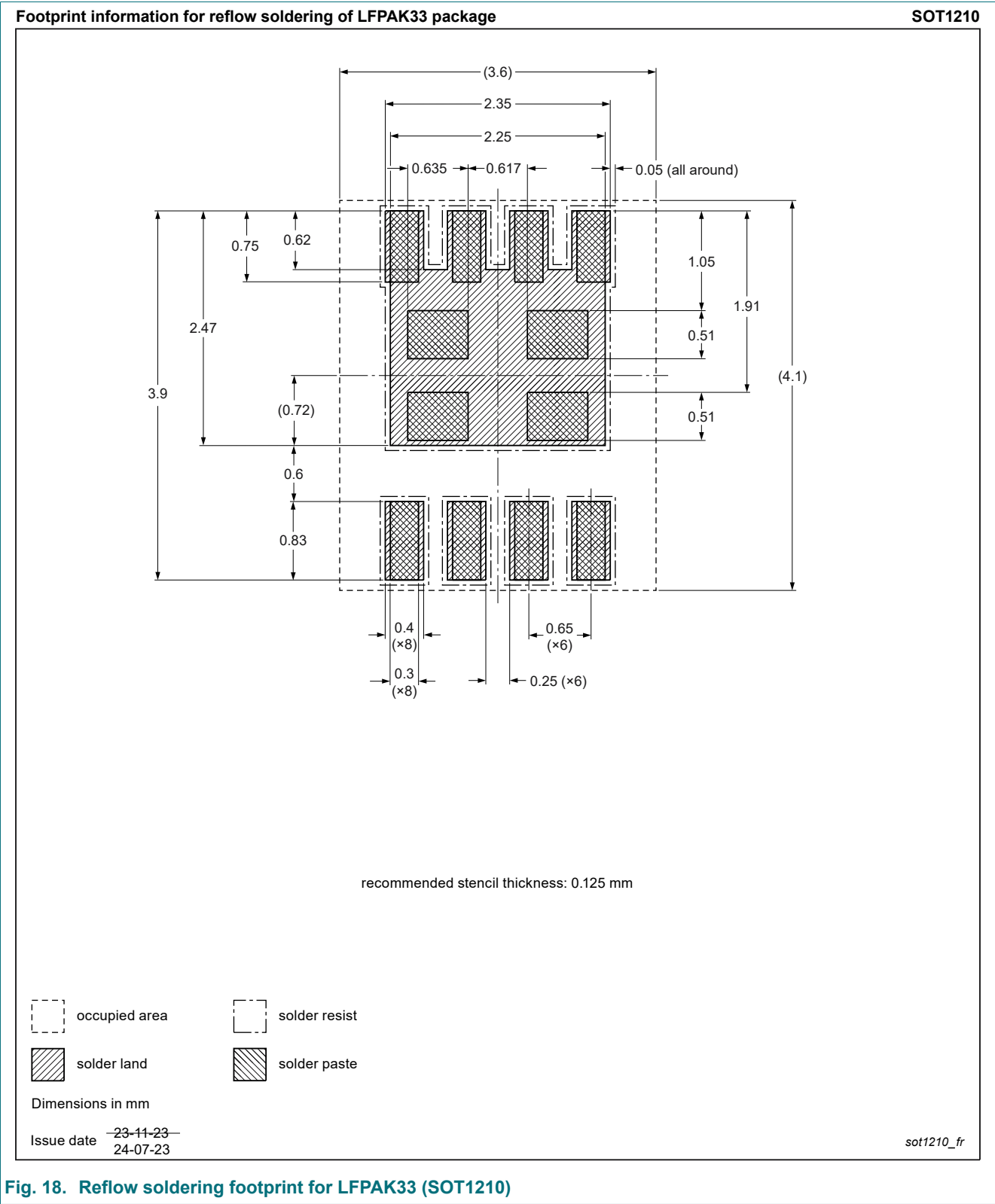


Fig. 17. Package outline LPAK33 (SOT1210)

12. Soldering



### 13. 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. |
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| Product [short] data sheet     | Production         | This document contains the product specification.                                     |

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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.....2

8. Limiting values..... 2

9. Thermal characteristics..... 4

10. Characteristics..... 5

11. Package outline..... 9

12. Soldering..... 10

13. Legal information.....11

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