



# MJD31C

100 V, 3 A NPN high power bipolar transistor

16 September 2020

Product data sheet

## 1. General description

NPN high power bipolar transistor in a power DPAK, TO-252 (SOT428C) Surface-Mounted Device (SMD) plastic package.

PNP complement: MJD32C

## 2. Features and benefits

- High thermal power dissipation capability
- High energy efficiency due to less heat generation
- Electrically similar to popular MJD31 series
- Low collector emitter saturation voltage
- Fast switching speeds

## 3. Applications

- Power management
- Load switch
- Linear mode voltage regulator
- Constant current drive backlighting application
- Motor drive
- Relay replacement

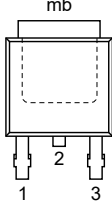
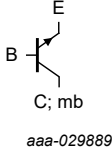
## 4. Quick reference data

Table 1. Quick reference data

| Symbol    | Parameter                 | Conditions                                     | Min | Typ | Max | Unit |
|-----------|---------------------------|------------------------------------------------|-----|-----|-----|------|
| $V_{CE0}$ | collector-emitter voltage | open base                                      | -   | -   | 100 | V    |
| $I_C$     | collector current         |                                                | -   | -   | 3   | A    |
| $I_{CM}$  | peak collector current    | single pulse; $t_p \leq 1$ ms                  | -   | -   | 5   | A    |
| $h_{FE}$  | DC current gain           | $V_{CE} = 4$ V; $I_C = 1$ A; $T_{amb} = 25$ °C | 25  | -   | -   |      |
|           |                           | $V_{CE} = 4$ V; $I_C = 3$ A; $T_{amb} = 25$ °C | 10  | -   | 50  |      |

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description                           | Simplified outline                                                                                  | Graphic symbol                                                                                    |
|-----|--------|---------------------------------------|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 1   | B      | base                                  | <br>DPAK (SOT428C) | <br>aaa-029889 |
| 2   | C      | collector                             |                                                                                                     |                                                                                                   |
| 3   | E      | emitter                               |                                                                                                     |                                                                                                   |
| mb  | C      | mounting base; connected to collector |                                                                                                     |                                                                                                   |

## 6. Ordering information

Table 3. Ordering information

| Type number | Package |                                                                                 |         |
|-------------|---------|---------------------------------------------------------------------------------|---------|
|             | Name    | Description                                                                     | Version |
| MJD31C      | DPAK    | Plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped) | SOT428C |

## 7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| MJD31C      | MJD31C       |

## 8. Limiting values

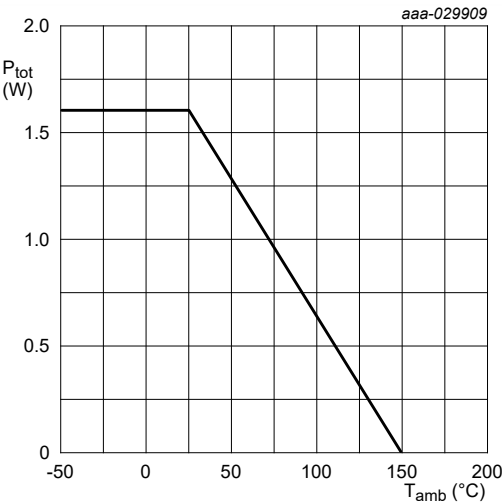
Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC601134).

| Symbol    | Parameter                 | Conditions                    |     | Min | Max | Unit |
|-----------|---------------------------|-------------------------------|-----|-----|-----|------|
| $V_{CEO}$ | collector-emitter voltage | open base                     |     | -   | 100 | V    |
| $V_{EBO}$ | emitter-base voltage      | open collector                |     | -   | 6   | V    |
| $I_C$     | collector current         |                               |     | -   | 3   | A    |
| $I_{CM}$  | peak collector current    | single pulse; $t_p \leq 1$ ms |     | -   | 5   | A    |
| $P_{tot}$ | total power dissipation   | $T_{mb} \leq 25$ °C           | [1] | -   | 15  | W    |
|           |                           | $T_{amb} \leq 25$ °C          | [2] | -   | 1.6 | W    |
| $T_j$     | junction temperature      |                               |     | -   | 150 | °C   |
| $T_{amb}$ | ambient temperature       |                               |     | -55 | 150 | °C   |
| $T_{stg}$ | storage temperature       |                               |     | -65 | 150 | °C   |

[1] Total power dissipation junction to mounting base.

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



FR4 PCB, single-sided copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

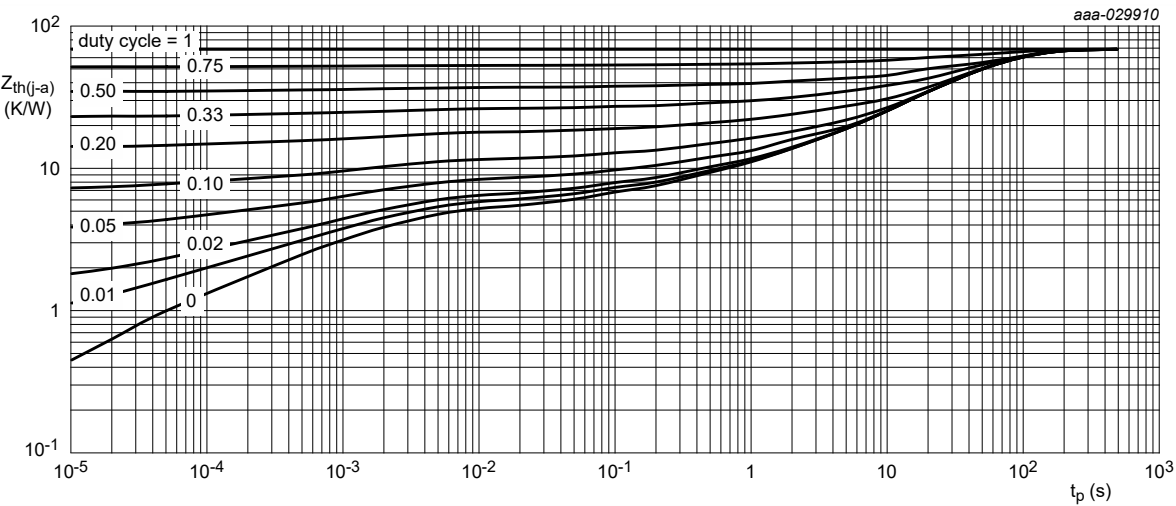
Fig. 1. Power derating curves SOT428C

9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol                | Parameter                                         | Conditions  |     | Min | Typ | Max | Unit |
|-----------------------|---------------------------------------------------|-------------|-----|-----|-----|-----|------|
| R <sub>th(j-mb)</sub> | thermal resistance from junction to mounting base | in free air |     | -   | -   | 9   | K/W  |
| R <sub>th(j-a)</sub>  | thermal resistance from junction to ambient       |             | [1] | -   | -   | 79  | K/W  |

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



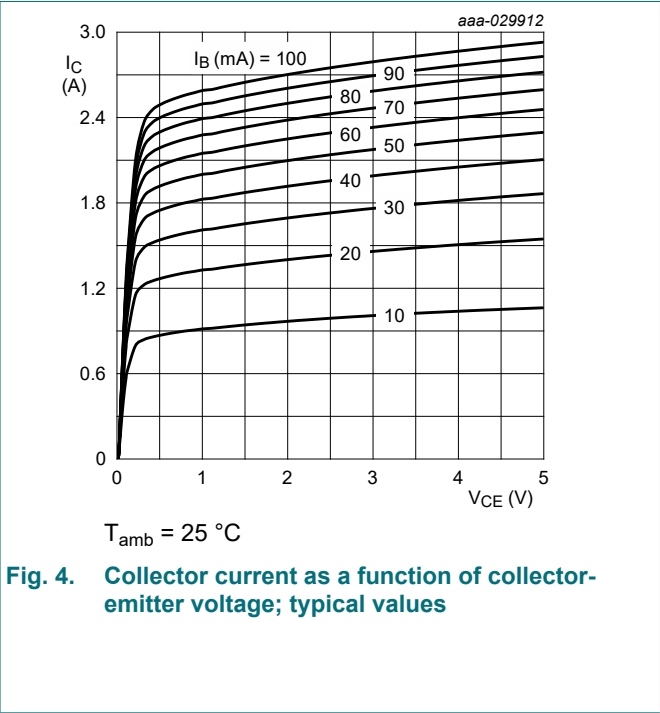
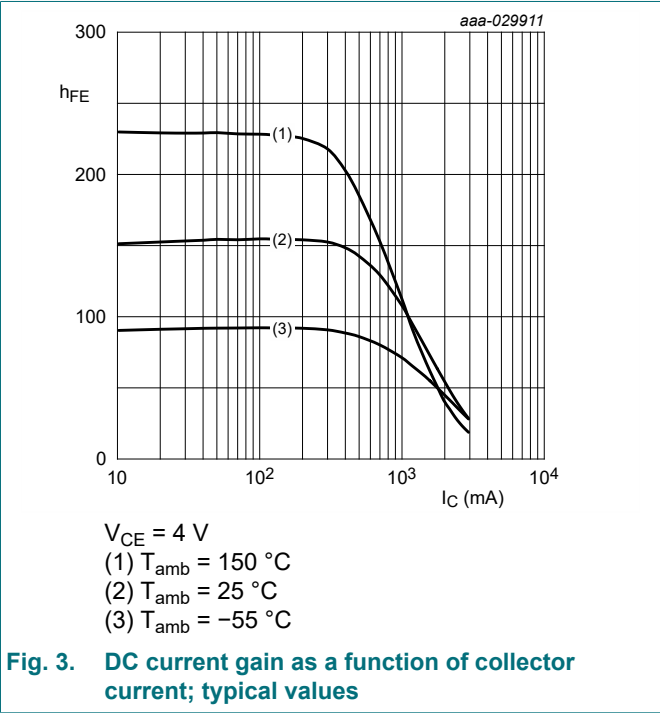
FR4 PCB, single-sided 70 μm copper, tin-plated, mounting pad for collector 1 cm<sup>2</sup>.

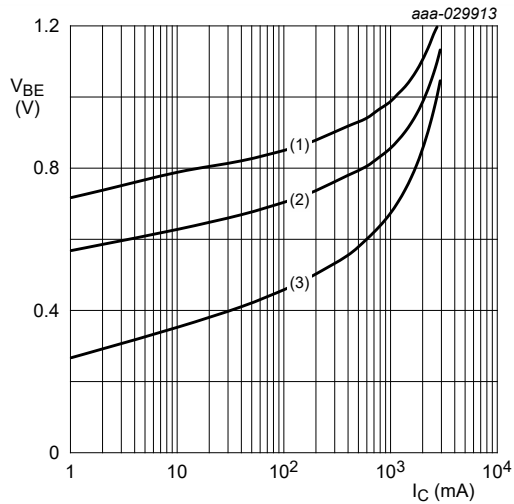
Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

| Symbol      | Parameter                            | Conditions                                                                                          | Min | Typ | Max | Unit          |
|-------------|--------------------------------------|-----------------------------------------------------------------------------------------------------|-----|-----|-----|---------------|
| $I_{CES}$   | collector-emitter cut-off current    | $V_{CE} = 80\text{ V}; V_{BE} = 0\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$                   | -   | -   | 1   | $\mu\text{A}$ |
|             |                                      | $V_{CE} = 64\text{ V}; V_{BE} = 0\text{ V}; T_j = 150\text{ }^{\circ}\text{C}$                      | -   | -   | 50  | $\mu\text{A}$ |
| $I_{EBO}$   | emitter-base cut-off current         | $V_{EB} = 5\text{ V}; I_C = 0\text{ A}; T_{amb} = 25\text{ }^{\circ}\text{C}$                       | -   | -   | 1   | $\mu\text{A}$ |
| $h_{FE}$    | DC current gain                      | $V_{CE} = 4\text{ V}; I_C = 1\text{ A}; T_{amb} = 25\text{ }^{\circ}\text{C}$                       | 25  | -   | -   |               |
|             |                                      | $V_{CE} = 4\text{ V}; I_C = 3\text{ A}; T_{amb} = 25\text{ }^{\circ}\text{C}$                       | 10  | -   | 50  |               |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C = 3\text{ A}; I_B = 375\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}$                       | -   | -   | 1.2 | V             |
| $V_{BE}$    | base-emitter voltage                 | $V_{CE} = 4\text{ V}; I_C = 3\text{ A}; T_{amb} = 25\text{ }^{\circ}\text{C}$                       | -   | -   | 1.8 | V             |
| $h_{fe}$    | small-signal current gain            | $V_{CE} = 10\text{ V}; I_C = 500\text{ mA}; f = 1\text{ kHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$ | 20  | -   | -   |               |
| $f_T$       | transition frequency                 | $V_{CE} = 10\text{ V}; I_C = 500\text{ mA}; f = 1\text{ MHz}; T_{amb} = 25\text{ }^{\circ}\text{C}$ | 3   | -   | -   | MHz           |





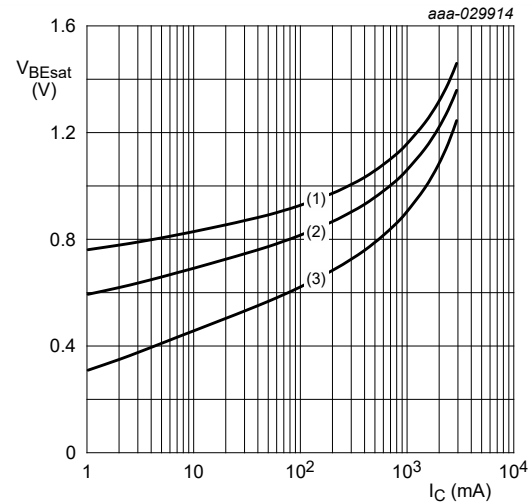
$V_{CE} = 4$  V

(1)  $T_{amb} = -55$  °C

(2)  $T_{amb} = 25$  °C

(3)  $T_{amb} = 150$  °C

**Fig. 5. Base-emitter voltage as a function of collector current; typical values**



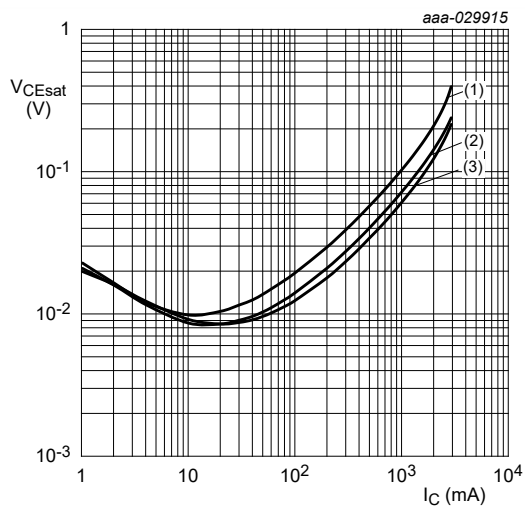
$I_C/I_B = 10$

(1)  $T_{amb} = -55$  °C

(2)  $T_{amb} = 25$  °C

(3)  $T_{amb} = 150$  °C

**Fig. 6. Base-emitter saturation voltage as a function of collector current; typical values**



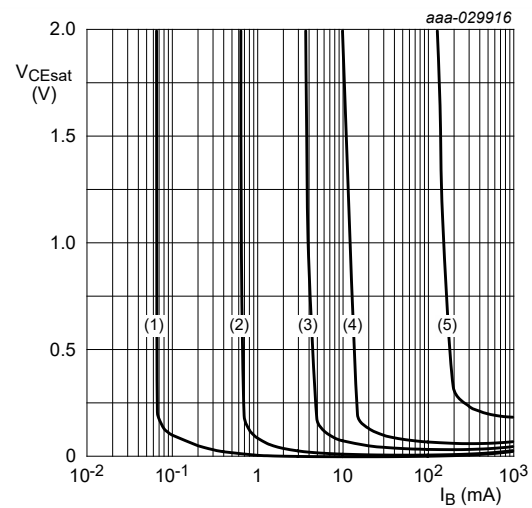
$I_C/I_B = 10$

(1)  $T_{amb} = 150$  °C

(2)  $T_{amb} = 25$  °C

(3)  $T_{amb} = -55$  °C

**Fig. 7. Collector-emitter saturation voltage as a function of collector current; typical values**



(1)  $I_C = 10$  mA

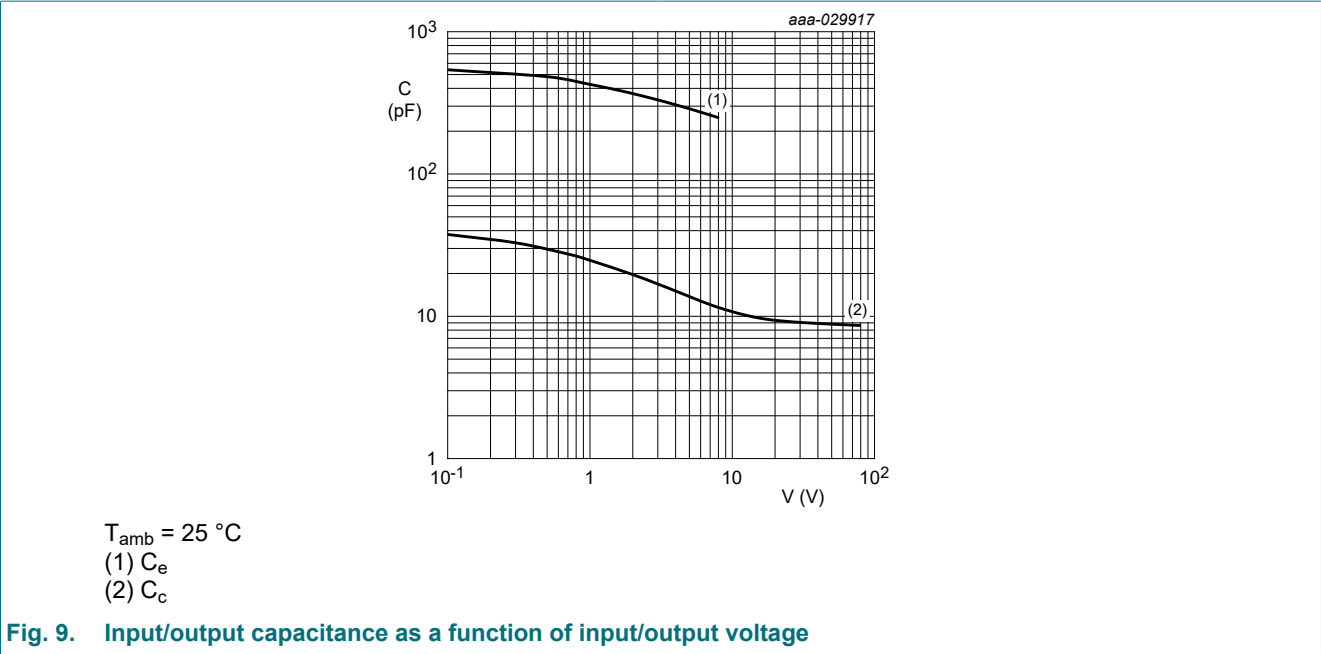
(2)  $I_C = 100$  mA

(3)  $I_C = 500$  mA

(4)  $I_C = 1000$  mA

(5)  $I_C = 3000$  mA

**Fig. 8. Collector-emitter saturation region as a function of base current; typical values**



11. Package outline

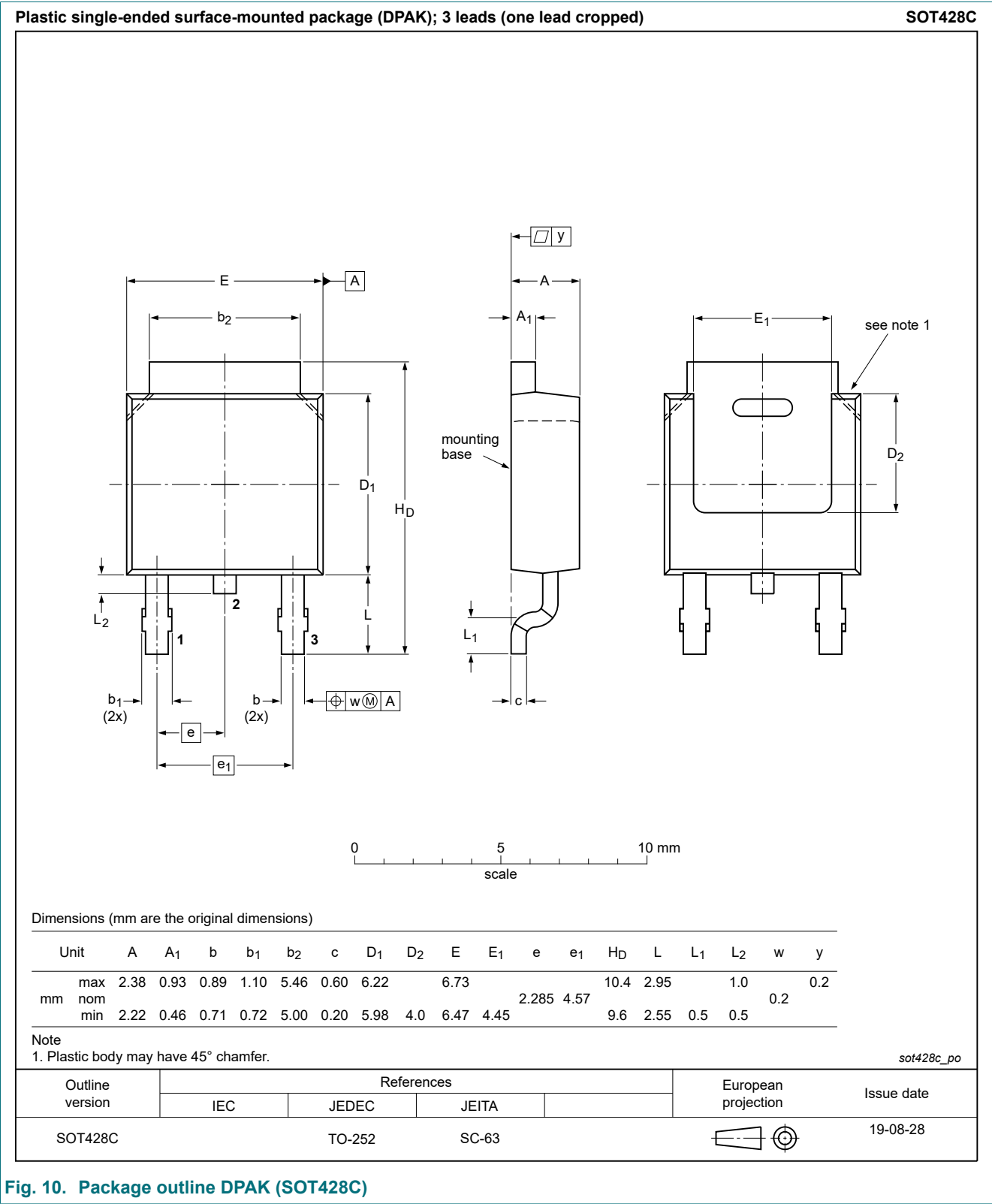


Fig. 10. Package outline DPAK (SOT428C)

12. Soldering

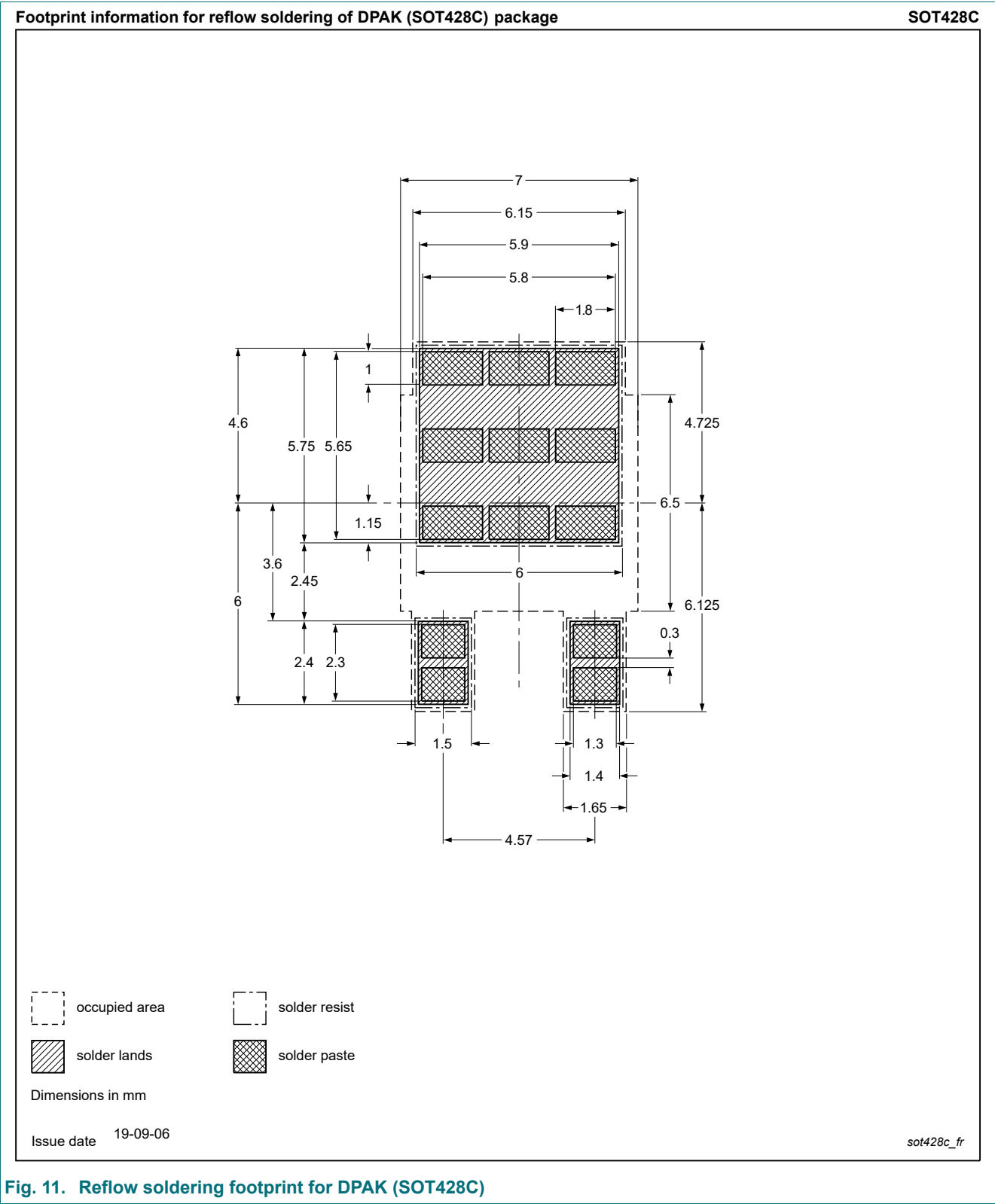


Fig. 11. Reflow soldering footprint for DPAK (SOT428C)

## 13. Revision history

**Table 8. Revision history**

| Data sheet ID  | Release date                                | Data sheet status      | Change notice | Supersedes |
|----------------|---------------------------------------------|------------------------|---------------|------------|
| MJD31C v.5     | 20200916                                    | Product data sheet     | -             | MJD31C v.4 |
| Modifications: | • Thermal characteristics: Figure 2 adapted |                        |               |            |
| MJD31C v.4     | 20190912                                    | Product data sheet     | -             | MJD31C v.3 |
| MJD31C v.3     | 20190802                                    | Product data sheet     | -             | MJD31C v.2 |
| MJD31C v.2     | 20190729                                    | Product data sheet     | -             | MJD31C v.1 |
| MJD31C v.1     | 20190523                                    | Preliminary data sheet | -             | -          |

## 14. Legal information

### Data sheet status

| Document status<br>[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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