



# MJD31CA

100 V, 3 A NPN high power bipolar transistor

23 November 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: MJD32CA

## 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
- AEC-Q101 qualified

## 3. Applications

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

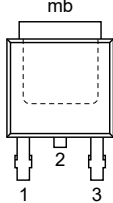
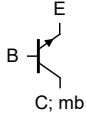
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CEO}$	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	 <p style="text-align: center;">DPAK (SOT428C)</p>	 <p style="text-align: center;">aaa-029889</p>
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
MJD31CA	DPAK	Plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)	SOT428C

## 7. Marking

Table 4. Marking codes

Type number	Marking code
MJD31CA	MJD31CA

## 8. Limiting values

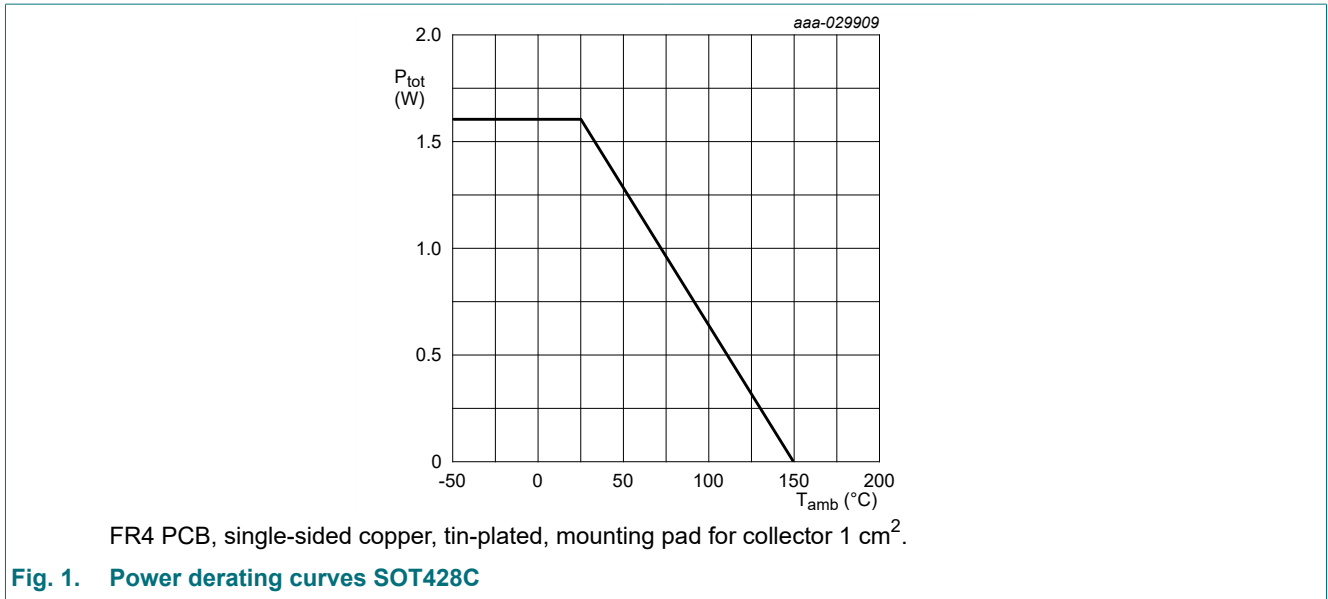
Table 5. Limiting values

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>.

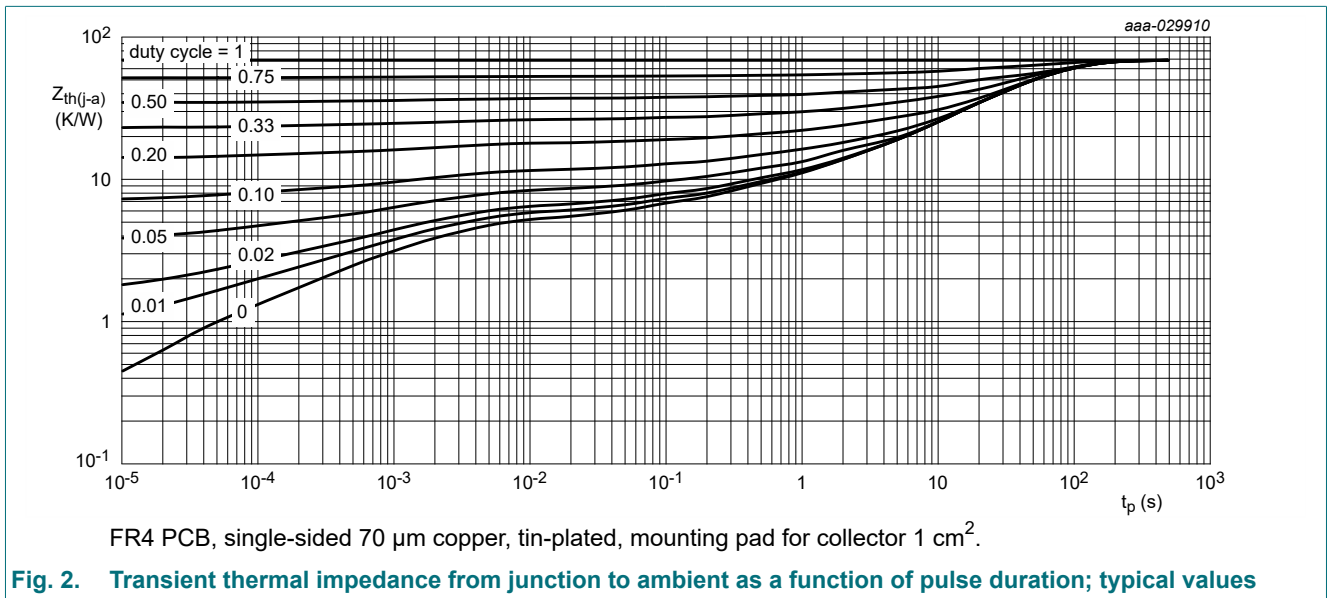


### 9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	in free air	-	-	9	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	[1]	-	-	79	K/W

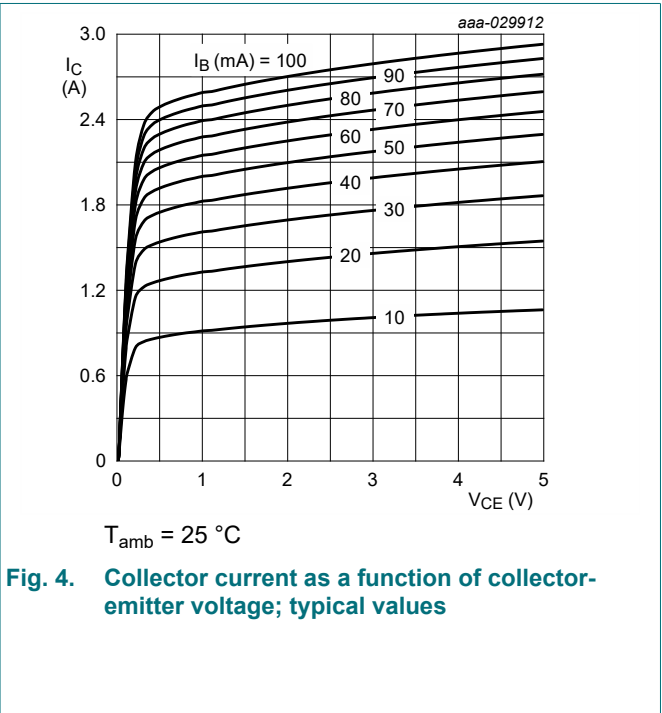
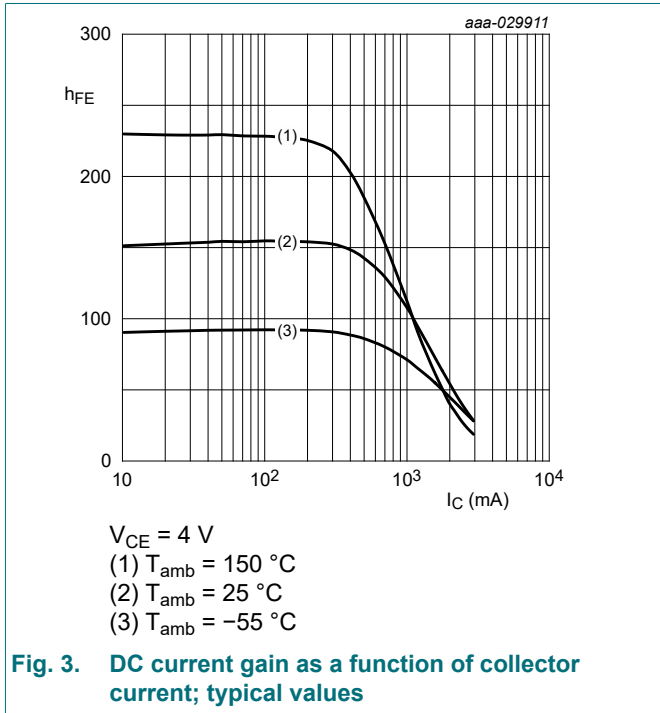
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated mounting pad for collector 1 cm<sup>2</sup>.

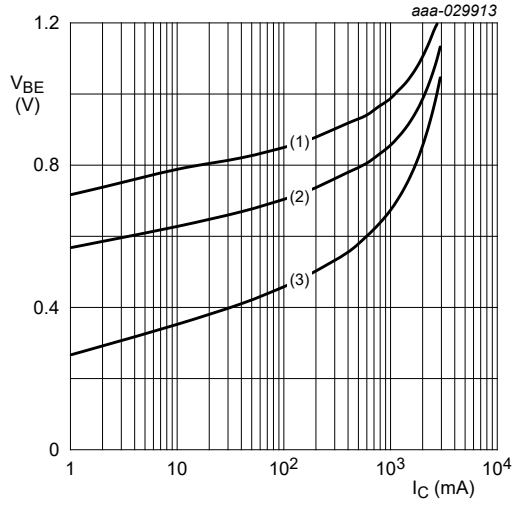


### 10. Characteristics

Table 7. Characteristics

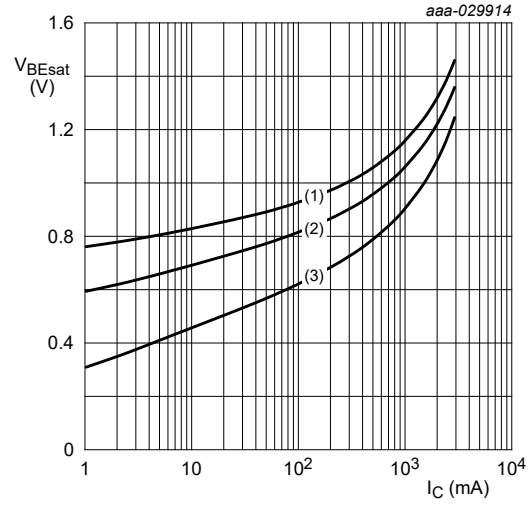
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CES}$	collector-emitter cut-off current	$V_{CE} = 80\text{ V}; V_{BE} = 0\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}$	-	-	1	$\mu\text{A}$
		$V_{CE} = 64\text{ V}; V_{BE} = 0\text{ V}; T_j = 150\text{ }^\circ\text{C}$	-	-	50	$\mu\text{A}$
$I_{EBO}$	emitter-base 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





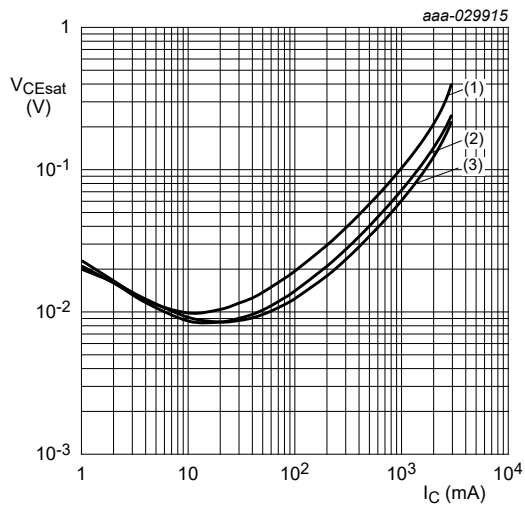
$V_{CE} = 4\text{ V}$   
 (1)  $T_{amb} = -55^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = 150^\circ\text{C}$

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



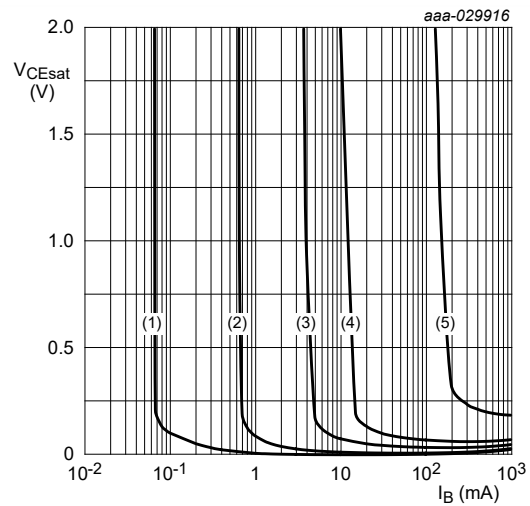
$I_C/I_B = 10$   
 (1)  $T_{amb} = -55^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = 150^\circ\text{C}$

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



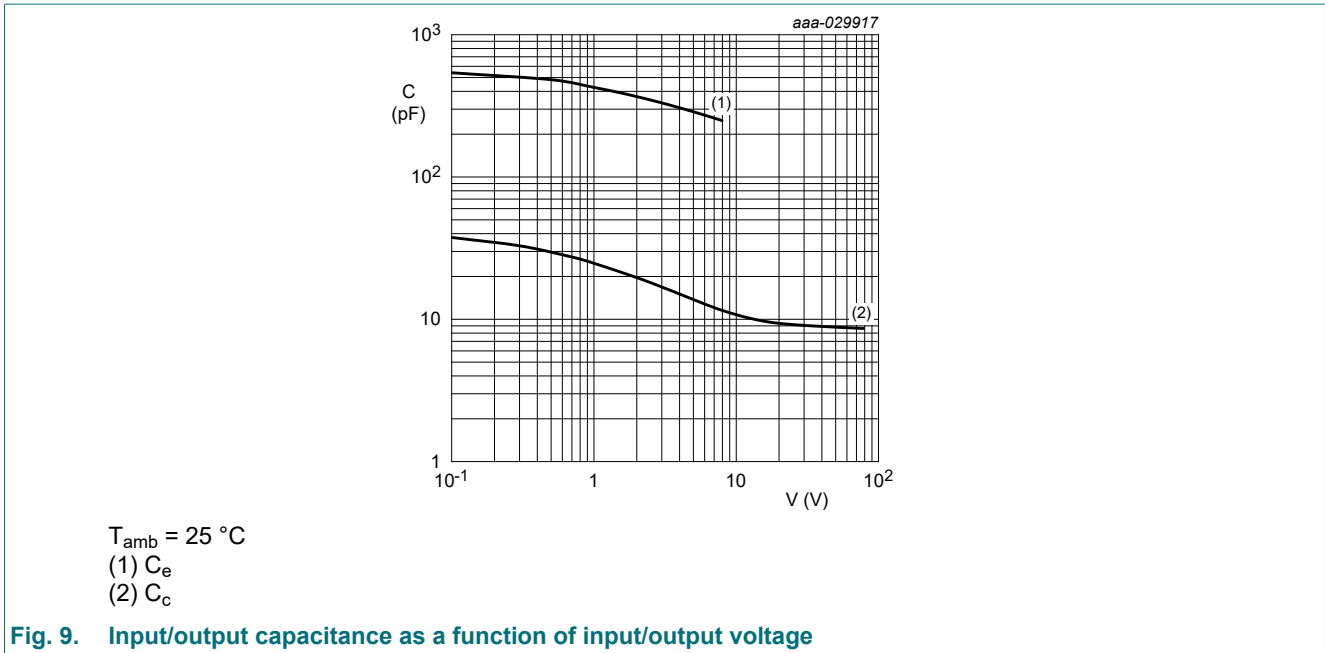
$I_C/I_B = 10$   
 (1)  $T_{amb} = 150^\circ\text{C}$   
 (2)  $T_{amb} = 25^\circ\text{C}$   
 (3)  $T_{amb} = -55^\circ\text{C}$

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



(1)  $I_C = 10\text{ mA}$   
 (2)  $I_C = 100\text{ mA}$   
 (3)  $I_C = 500\text{ mA}$   
 (4)  $I_C = 1000\text{ mA}$   
 (5)  $I_C = 3000\text{ mA}$

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



## 11. Test information

### Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - *Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

## 12. Package outline

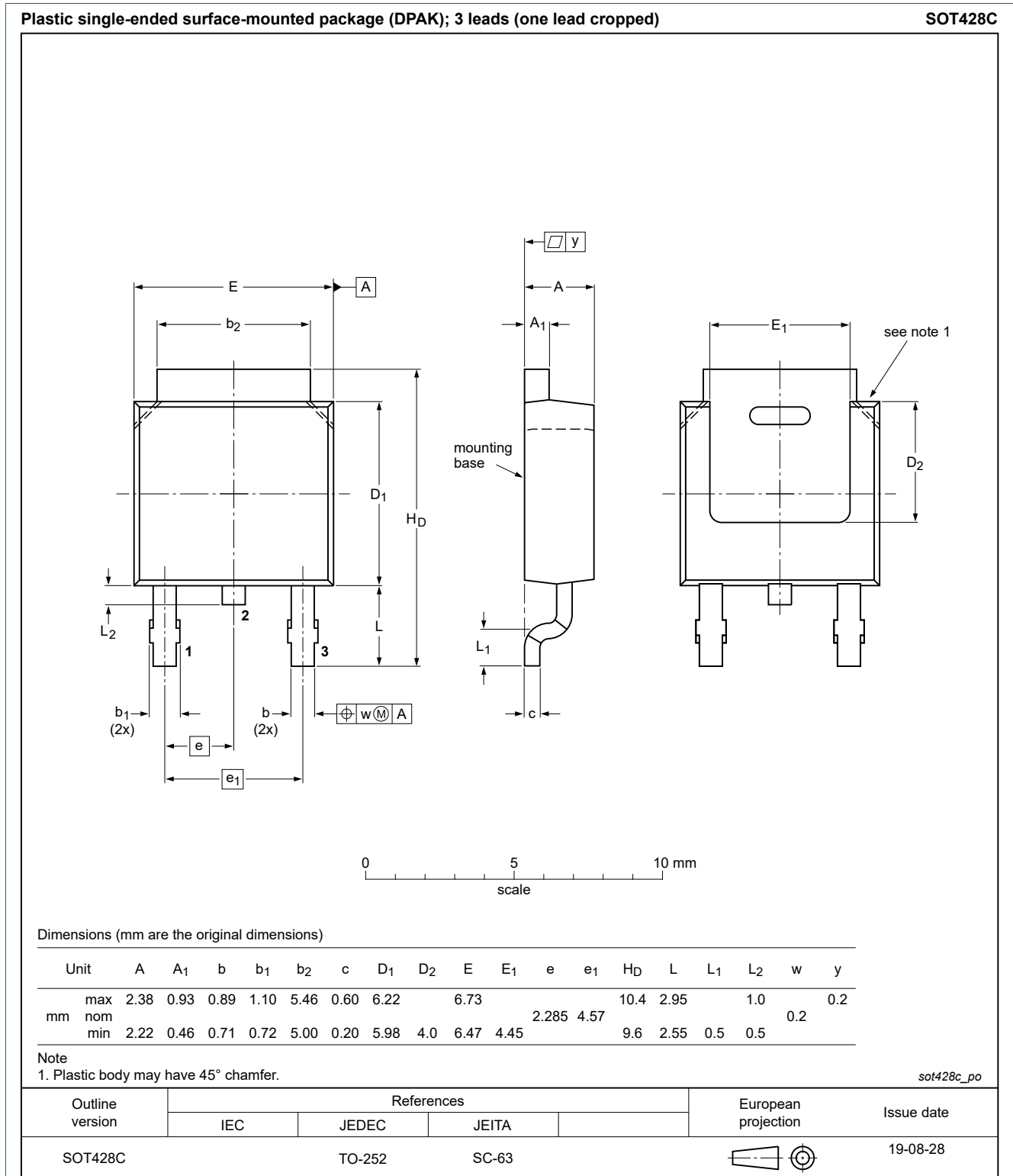


Fig. 10. Package outline DPAK (SOT428C)

### 13. Soldering

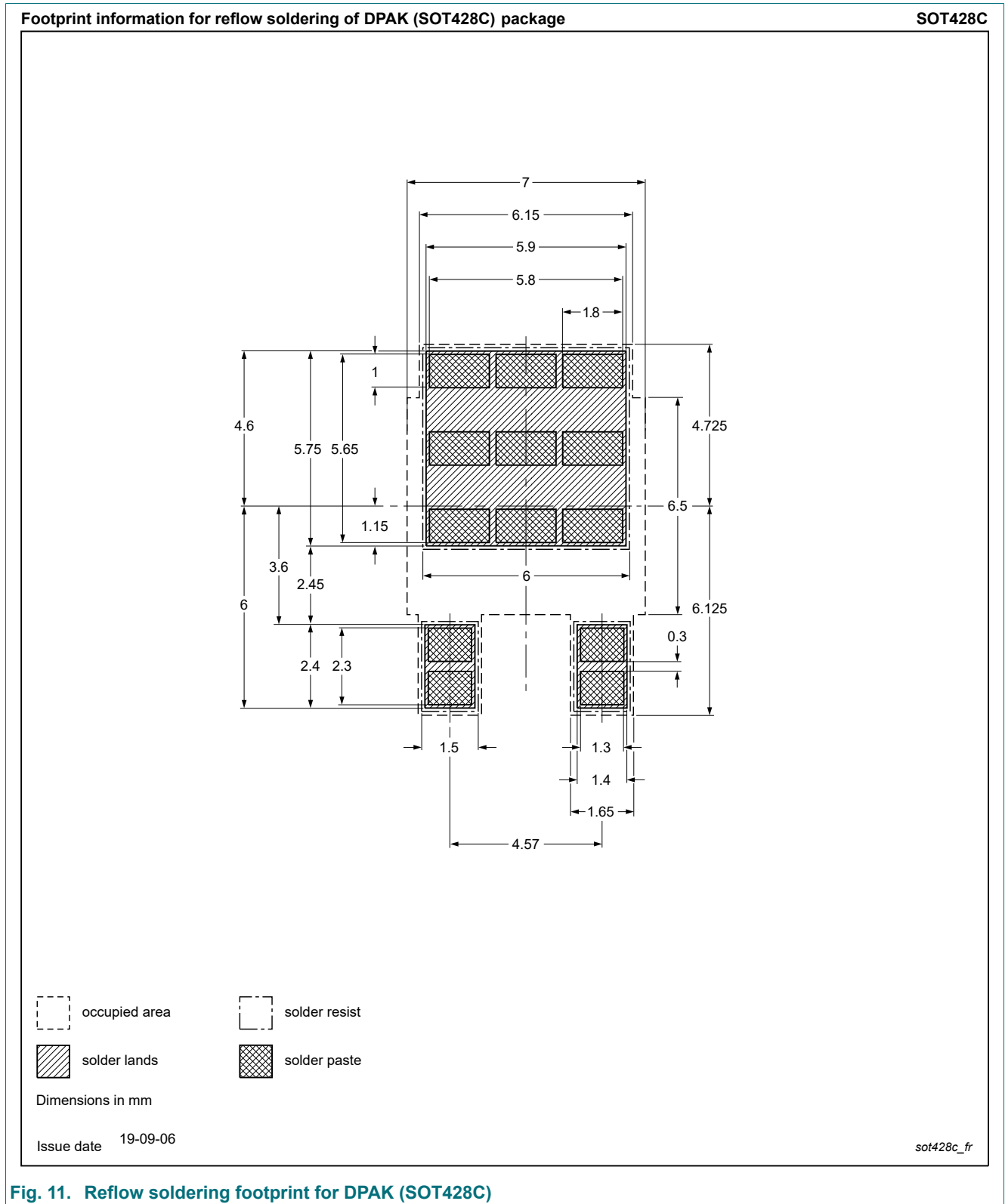


Fig. 11. Reflow soldering footprint for DPAK (SOT428C)



## 14. Revision history

**Table 8. Revision history**

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
MJD31CA v.6	20201123	Product data sheet	-	MJD31CA v.5
Modifications:	• Characteristics $h_{fe}$ : conditions corrected			
MJD31CA v.5	20200916	Product data sheet	-	MJD31CA v.4
MJD31CA v.4	20190912	Product data sheet	-	MJD31CA v.3
MJD31CA v.3	20190802	Product data sheet	-	MJD31CA v.2
MJD31CA v.2	20190729	Product data sheet	-	MJD31CA v.1
MJD31CA v.1	20190523	Preliminary 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.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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