

# PIMN31

500 mA, 50 V NPN/NPN double resistor-equipped transistor;  
R1 = 1 k $\Omega$ , R2 = 10 k $\Omega$

Rev. 01 — 19 June 2007

Product data sheet

## 1. Product profile

### 1.1 General description

500 mA, 50 V NPN/NPN double Resistor-Equipped Transistor (RET) in a small SOT457 (SC-74) Surface-Mounted Device (SMD) plastic package.

### 1.2 Features

- 500 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs
- AEC-Q101 qualified

### 1.3 Applications

- Digital application in automotive and industrial segments
- Switching loads

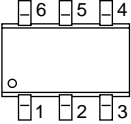
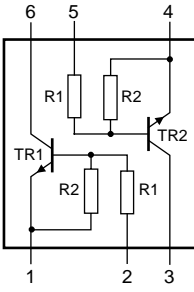
### 1.4 Quick reference data

Table 1. Quick reference data

| Symbol                | Parameter                 | Conditions | Min | Typ | Max | Unit       |
|-----------------------|---------------------------|------------|-----|-----|-----|------------|
| <b>Per transistor</b> |                           |            |     |     |     |            |
| V <sub>CEO</sub>      | collector-emitter voltage | open base  | -   | -   | 50  | V          |
| I <sub>O</sub>        | output current            |            | -   | -   | 500 | mA         |
| R1                    | bias resistor 1 (input)   |            | 0.7 | 1   | 1.3 | k $\Omega$ |
| R2/R1                 | bias resistor ratio       |            | 9   | 10  | 11  |            |

## 2. Pinning information

Table 2. Pinning

| Pin | Description            | Simplified outline  | Symbol  |
|-----|------------------------|---|---|
| 1   | GND (emitter) TR1      |  |  |
| 2   | input (base) TR1       |   |   |
| 3   | output (collector) TR2 |   |   |
| 4   | GND (emitter) TR2      |   |   |
| 5   | input (base) TR2       |   |   |
| 6   | output (collector) TR1 |   |   |

## 3. Ordering information

Table 3. Ordering information

| Type number | Package |  | Version |
|-------------|---------|--|---------|
|             | Name    | Description                                      |         |
| PIMN31      | SC-74   | plastic surface-mounted package (TSOP6); 6 leads | SOT457  |

## 4. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PIMN31      | 4E           |

## 5. Limiting values

Table 5. Limiting values

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

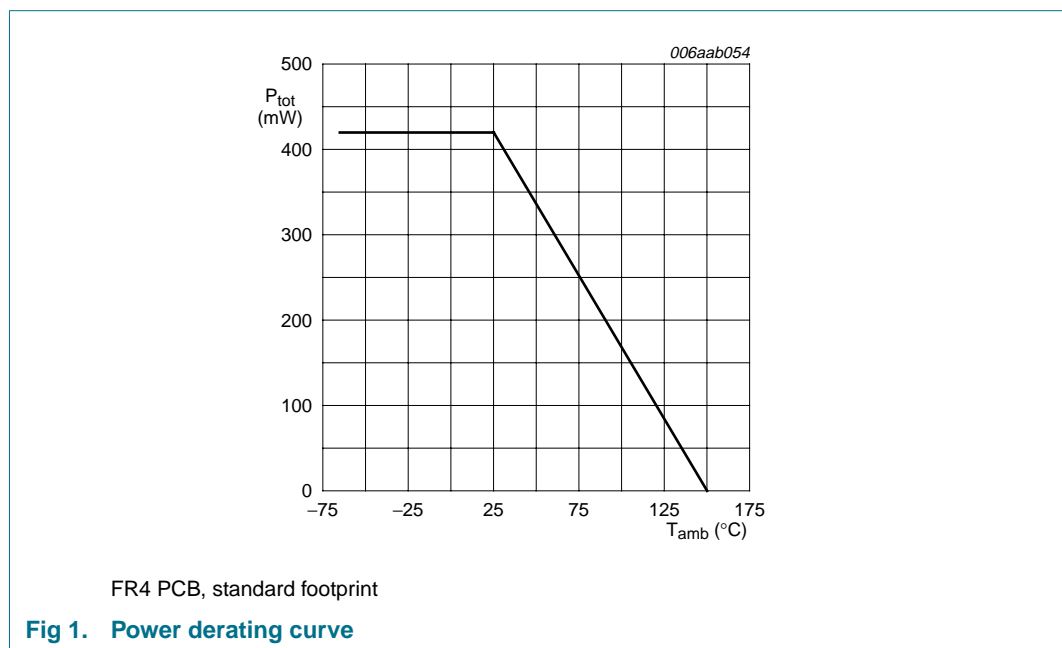
| Symbol                | Parameter                 | Conditions                  | Min   | Max | Unit |
|-----------------------|---------------------------|-----------------------------|-------|-----|------|
| <b>Per transistor</b> |                           |                             |       |     |      |
| $V_{CBO}$             | collector-base voltage    | open emitter                | -     | 50  | V    |
| $V_{CEO}$             | collector-emitter voltage | open base                   | -     | 50  | V    |
| $V_{EBO}$             | emitter-base voltage      | open collector              | -     | 5   | V    |
| $V_I$                 | input voltage             | positive                    | -     | +12 | V    |
|                       |                           | negative                    | -     | -5  | V    |
|                       |                           |                             |       |     |      |
| $I_O$                 | output current            |                             | -     | 500 | mA   |
| $P_{tot}$             | total power dissipation   | $T_{amb} \leq 25\text{ °C}$ | [1] - | 290 | mW   |

**Table 5. Limiting values ...continued**

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

| Symbol            | Parameter               | Conditions                  | Min   | Max  | Unit |
|-------------------|-------------------------|-----------------------------|-------|------|------|
| <b>Per device</b> |                         |                             |       |      |      |
| $P_{tot}$         | total power dissipation | $T_{amb} \leq 25\text{ °C}$ | [1] - | 420  | mW   |
| $T_j$             | junction temperature    |                             | -     | 150  | °C   |
| $T_{amb}$         | ambient temperature     |                             | -65   | +150 | °C   |
| $T_{stg}$         | storage temperature     |                             | -65   | +150 | °C   |

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

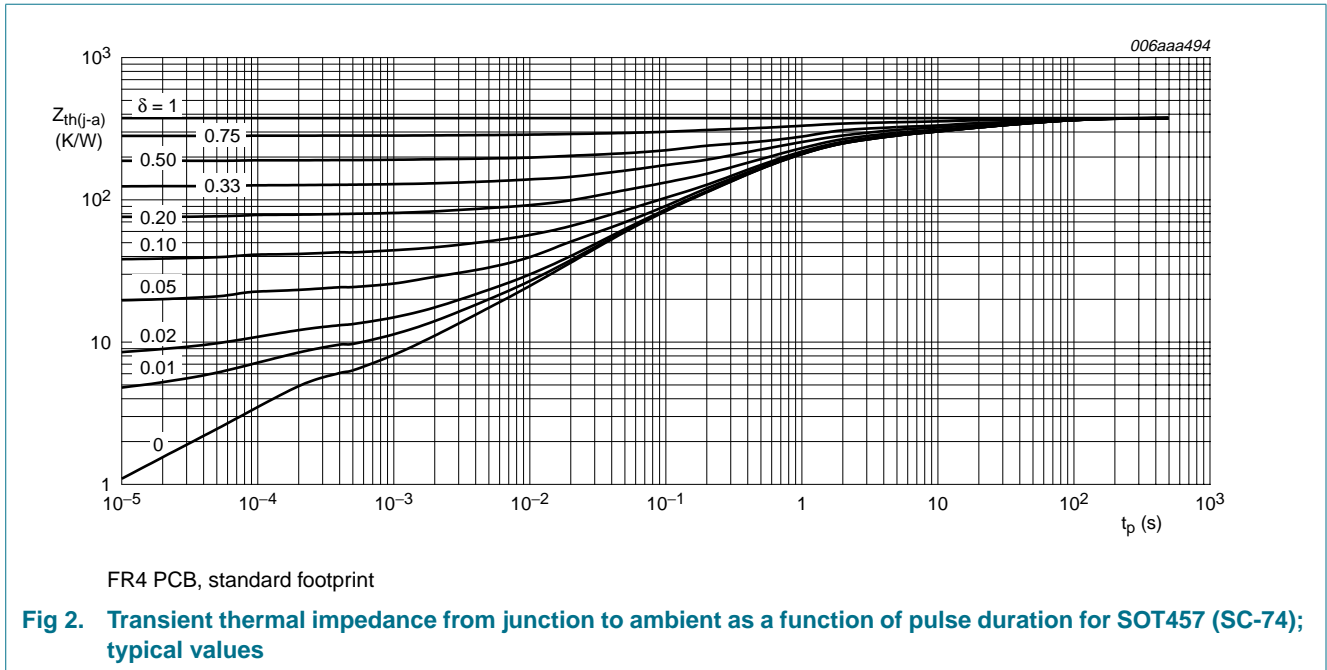


## 6. Thermal characteristics

**Table 6. Thermal characteristics**

| Symbol                | Parameter  | Conditions  | Min   | Typ | Max | Unit |
|-----------------------|--|-------------|-------|-----|-----|------|
| <b>Per transistor</b> |  |             |       |     |     |      |
| $R_{th(j-a)}$         | thermal resistance from junction to ambient      | in free air | [1] - | -   | 431 | K/W  |
| $R_{th(j-sp)}$        | thermal resistance from junction to solder point |             | -     | -   | 105 | K/W  |
| <b>Per device</b>     |  |             |       |     |     |      |
| $R_{th(j-a)}$         | thermal resistance from junction to ambient      | in free air | [1] - | -   | 298 | K/W  |

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

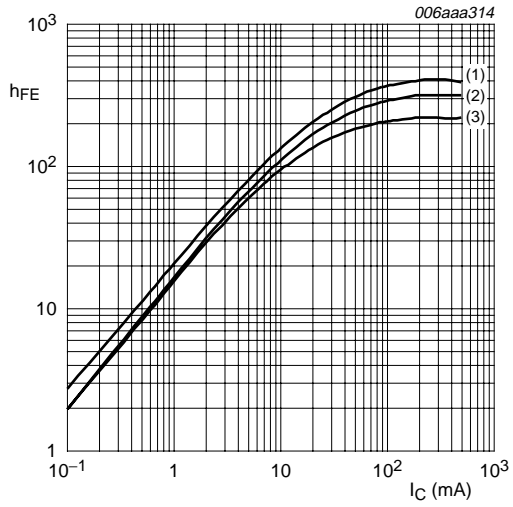


## 7. Characteristics

**Table 7. Characteristics**

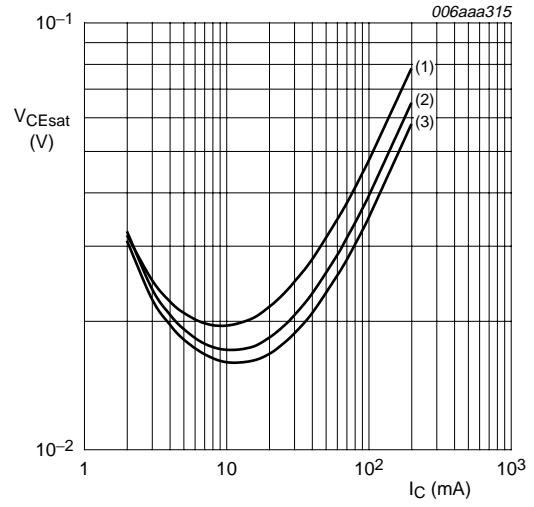
$T_{amb} = 25^{\circ}C$  unless otherwise specified.

| Symbol                | Parameter                            | Conditions   | Min | Typ | Max  | Unit          |
|-----------------------|--------------------------------------|--|-----|-----|------|---------------|
| <b>Per transistor</b> |                                      |  |     |     |      |               |
| $I_{CBO}$             | collector-base cut-off current       | $V_{CB} = 50\text{ V}; I_E = 0\text{ A}$                         | -   | -   | 100  | nA            |
| $I_{CEO}$             | collector-emitter cut-off current    | $V_{CE} = 50\text{ V}; I_B = 0\text{ A}$                         | -   | -   | 0.5  | $\mu\text{A}$ |
| $I_{EBO}$             | emitter-base cut-off current         | $V_{EB} = 5\text{ V}; I_C = 0\text{ A}$                          | -   | -   | 0.72 | mA            |
| $h_{FE}$              | DC current gain                      | $V_{CE} = 5\text{ V}; I_C = 50\text{ mA}$                        | 70  | -   | -    |               |
| $V_{CEsat}$           | collector-emitter saturation voltage | $I_C = 50\text{ mA}; I_B = 2.5\text{ mA}$                        | -   | -   | 0.3  | V             |
| $V_{I(off)}$          | off-state input voltage              | $V_{CE} = 5\text{ V}; I_C = 100\ \mu\text{A}$                    | 0.3 | 0.6 | 1    | V             |
| $V_{I(on)}$           | on-state input voltage               | $V_{CE} = 0.3\text{ V}; I_C = 20\text{ mA}$                      | 0.4 | 0.8 | 1.4  | V             |
| R1                    | bias resistor 1 (input)              |  | 0.7 | 1   | 1.3  | kΩ            |
| R2/R1                 | bias resistor ratio                  |  | 9   | 10  | 11   |               |
| $C_c$                 | collector capacitance                | $V_{CB} = 10\text{ V}; I_E = i_e = 0\text{ A}; f = 1\text{ MHz}$ | -   | 7   | -    | pF            |



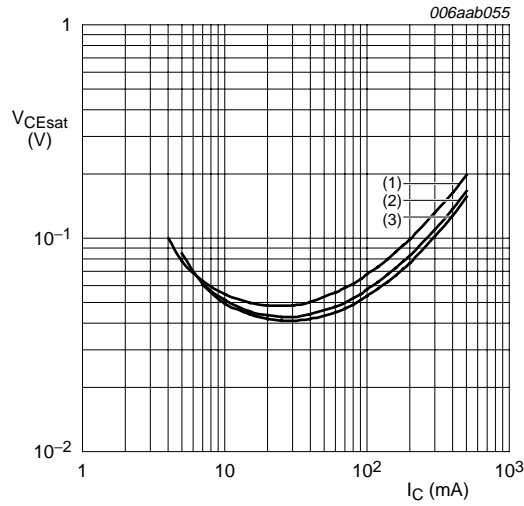
$V_{CE} = 5\text{ V}$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

**Fig 3. DC current gain as a function of collector current; typical values**



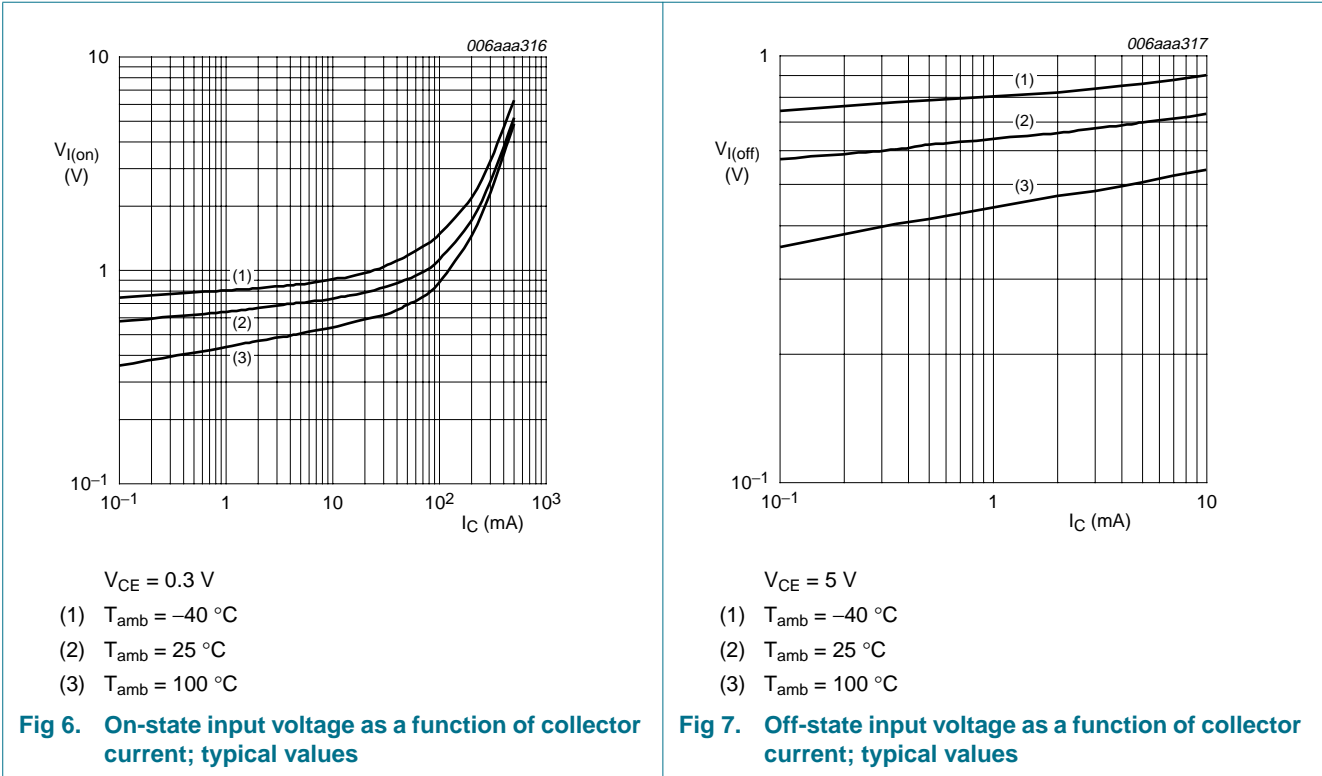
$I_C/I_B = 20$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

**Fig 4. Collector-emitter saturation voltage as a function of collector current; typical values**



$I_C/I_B = 50$   
 (1)  $T_{amb} = 100\text{ }^{\circ}\text{C}$   
 (2)  $T_{amb} = 25\text{ }^{\circ}\text{C}$   
 (3)  $T_{amb} = -40\text{ }^{\circ}\text{C}$

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

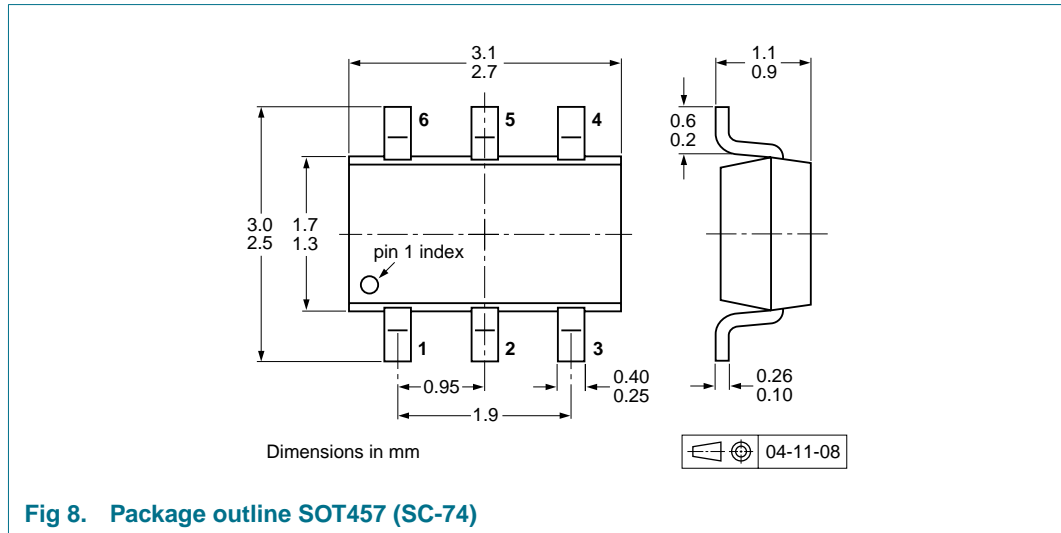


## 8. Test information

### 8.1 Quality information

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

## 9. Package outline



## 10. Packing information

**Table 8. Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code.<sup>[1]</sup>

| Type number | Package | Description                        | Packing quantity    |       |
|-------------|---------|------------------------------------|---------------------|-------|
|             |         |                                    | 3000                | 10000 |
| PIMN31      | SOT457  | 4 mm pitch, 8 mm tape and reel; T1 | <sup>[2]</sup> -115 | -135  |
|             |         | 4 mm pitch, 8 mm tape and reel; T2 | <sup>[3]</sup> -125 | -165  |

[1] For further information and the availability of packing methods, see [Section 14](#).

[2] T1: normal taping

[3] T2: reverse taping

### 11. Soldering

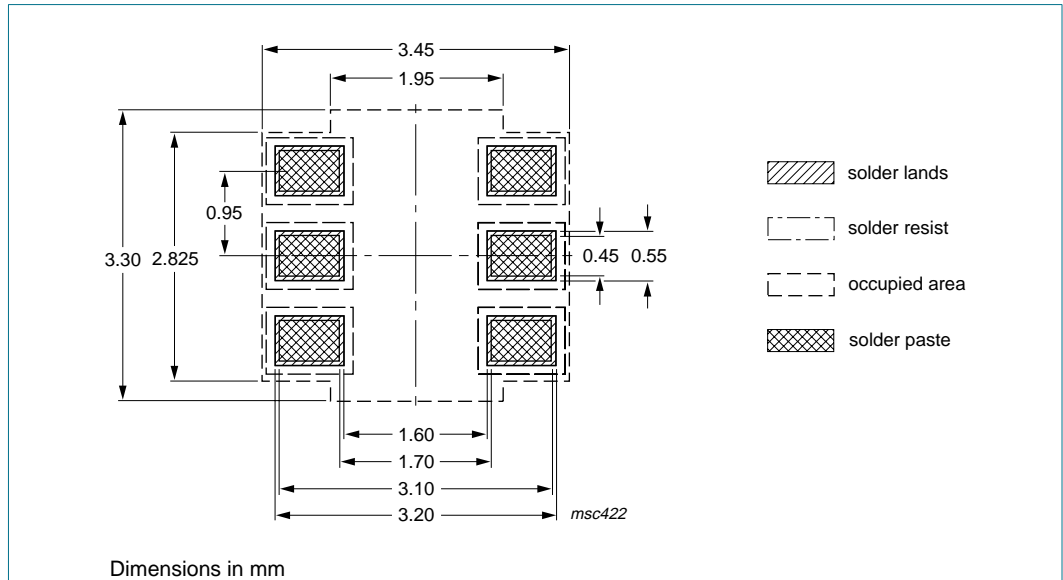


Fig 9. Reflow soldering footprint SOT457 (SC-74)

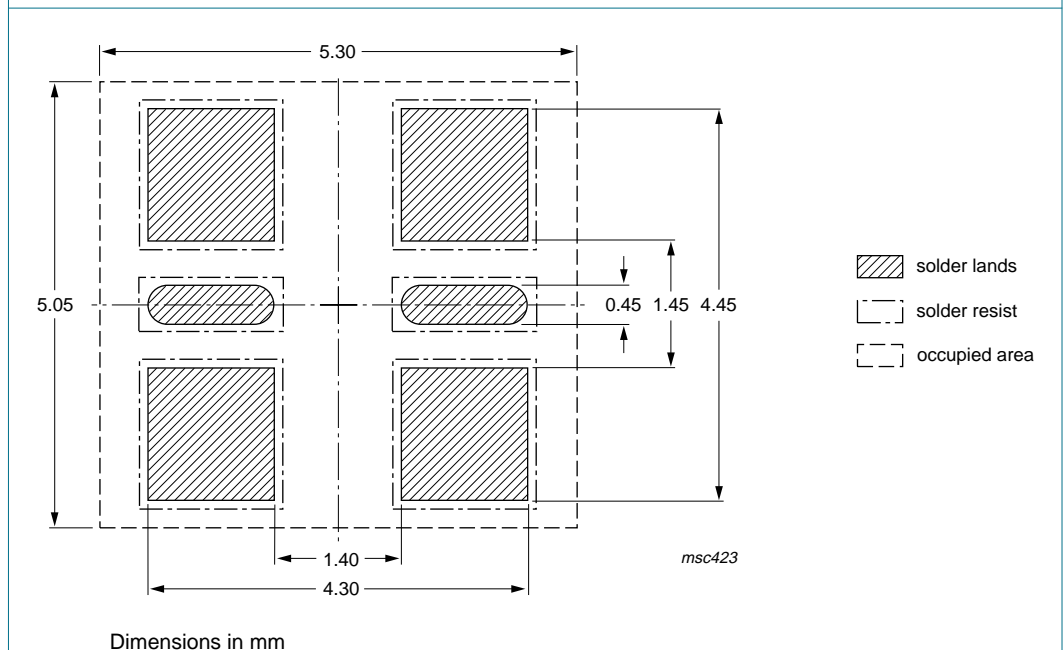


Fig 10. Wave soldering footprint SOT457 (SC-74)



## 12. Revision history

**Table 9.** Revision history

| Document ID | Release date | Data sheet status  | Change notice | Supersedes |
|-------------|--------------|--------------------|---------------|------------|
| PIMN31_1    | 20070619     | Product data sheet | -             | -          |

## 13. Legal information

### 13.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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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## 15. Contents

|           |                                      |           |
|-----------|--------------------------------------|-----------|
| <b>1</b>  | <b>Product profile</b> .....         | <b>1</b>  |
| 1.1       | General description .....            | 1         |
| 1.2       | Features .....                       | 1         |
| 1.3       | Applications .....                   | 1         |
| 1.4       | Quick reference data .....           | 1         |
| <b>2</b>  | <b>Pinning information</b> .....     | <b>2</b>  |
| <b>3</b>  | <b>Ordering information</b> .....    | <b>2</b>  |
| <b>4</b>  | <b>Marking</b> .....                 | <b>2</b>  |
| <b>5</b>  | <b>Limiting values</b> .....         | <b>2</b>  |
| <b>6</b>  | <b>Thermal characteristics</b> ..... | <b>3</b>  |
| <b>7</b>  | <b>Characteristics</b> .....         | <b>4</b>  |
| <b>8</b>  | <b>Test information</b> .....        | <b>6</b>  |
| 8.1       | Quality information .....            | 6         |
| <b>9</b>  | <b>Package outline</b> .....         | <b>7</b>  |
| <b>10</b> | <b>Packing information</b> .....     | <b>7</b>  |
| <b>11</b> | <b>Soldering</b> .....               | <b>8</b>  |
| <b>12</b> | <b>Revision history</b> .....        | <b>9</b>  |
| <b>13</b> | <b>Legal information</b> .....       | <b>10</b> |
| 13.1      | Data sheet status .....              | 10        |
| 13.2      | Definitions .....                    | 10        |
| 13.3      | Disclaimers .....                    | 10        |
| 13.4      | Trademarks .....                     | 10        |
| <b>14</b> | <b>Contact information</b> .....     | <b>10</b> |
| <b>15</b> | <b>Contents</b> .....                | <b>11</b> |

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