

# PMN34UP

20 V, 5 A P-channel Trench MOSFET

Rev. 1 — 9 May 2011

Product data sheet

## 1. Product profile

### 1.1 General description

P-channel enhancement mode Field-Effect Transistor (FET) in a small SOT457 (SC-74) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

### 1.2 Features and benefits

- 1.8 V  $R_{DSon}$  rated
- Trench MOSFET technology
- Very fast switching

### 1.3 Applications

- Relay driver
- High-side loadswitch
- High-speed line driver
- Switching circuits

### 1.4 Quick reference data

Table 1. Quick reference data

| Symbol                        | Parameter                        | Conditions                                                        | Min                 | Typ | Max | Unit |
|-------------------------------|----------------------------------|-------------------------------------------------------------------|---------------------|-----|-----|------|
| $V_{DS}$                      | drain-source voltage             | $T_j = 25\text{ °C}$                                              | -                   | -   | -20 | V    |
| $V_{GS}$                      | gate-source voltage              |                                                                   | -8                  | -   | 8   | V    |
| $I_D$                         | drain current                    | $V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ °C}$                  | <a href="#">[1]</a> | -   | -5  | A    |
| <b>Static characteristics</b> |                                  |                                                                   |                     |     |     |      |
| $R_{DSon}$                    | drain-source on-state resistance | $V_{GS} = -4.5\text{ V}; I_D = -2.4\text{ A}; T_j = 25\text{ °C}$ | -                   | 34  | 40  | mΩ   |

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

## 2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline    | Graphic symbol   |
|-----|--------|-------------|-----------------------|------------------|
| 1   | D      | drain       | <p>SOT457 (TSOP6)</p> | <p>017aaa094</p> |
| 2   | D      | drain       |                       |                  |
| 3   | G      | gate        |                       |                  |
| 4   | S      | source      |                       |                  |
| 5   | D      | drain       |                       |                  |
| 6   | D      | drain       |                       |                  |



### 3. Ordering information

Table 3. Ordering information

| Type number | Package |                                                  | Version |
|-------------|---------|--------------------------------------------------|---------|
|             | Name    | Description                                      |         |
| PMN34UP     | TSOP6   | plastic surface-mounted package (TSOP6); 6 leads | SOT457  |

### 4. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PMN34UP     | ZY           |

### 5. Limiting values

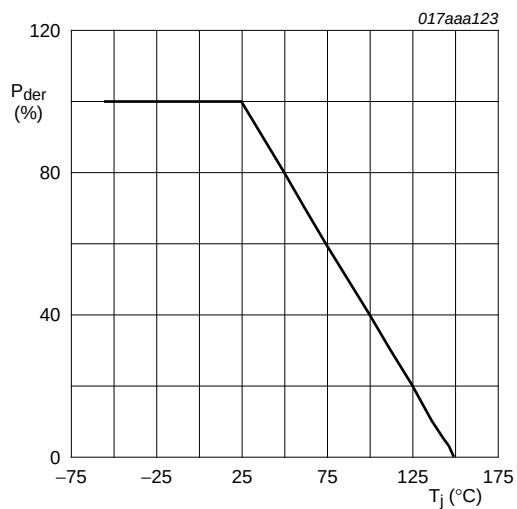
Table 5. Limiting values

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

| Symbol                    | Parameter               | Conditions                                                                              | Min | Max  | Unit               |
|---------------------------|-------------------------|-----------------------------------------------------------------------------------------|-----|------|--------------------|
| $V_{DS}$                  | drain-source voltage    | $T_j = 25\text{ }^{\circ}\text{C}$                                                      | -   | -20  | V                  |
| $V_{GS}$                  | gate-source voltage     |                                                                                         | -8  | 8    | V                  |
| $I_D$                     | drain current           | $V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$ <a href="#">[1]</a>      | -   | -5   | A                  |
|                           |                         | $V_{GS} = -4.5\text{ V}; T_{amb} = 100\text{ }^{\circ}\text{C}$ <a href="#">[1]</a>     | -   | -3.1 | A                  |
| $I_{DM}$                  | peak drain current      | $T_{amb} = 25\text{ }^{\circ}\text{C}$ ; single pulse; $t_p \leq 10\text{ }\mu\text{s}$ | -   | -20  | A                  |
| $P_{tot}$                 | total power dissipation | $T_{amb} = 25\text{ }^{\circ}\text{C}$ <a href="#">[2]</a>                              | -   | 540  | mW                 |
|                           |                         | <a href="#">[1]</a>                                                                     | -   | 1385 | mW                 |
|                           |                         | $T_{sp} = 25\text{ }^{\circ}\text{C}$                                                   | -   | 6250 | mW                 |
| $T_j$                     | junction temperature    |                                                                                         | -55 | 150  | $^{\circ}\text{C}$ |
| $T_{amb}$                 | ambient temperature     |                                                                                         | -55 | 150  | $^{\circ}\text{C}$ |
| $T_{stg}$                 | storage temperature     |                                                                                         | -65 | 150  | $^{\circ}\text{C}$ |
| <b>Source-drain diode</b> |                         |                                                                                         |     |      |                    |
| $I_S$                     | source current          | $T_{amb} = 25\text{ }^{\circ}\text{C}$ <a href="#">[1]</a>                              | -   | -1.5 | A                  |

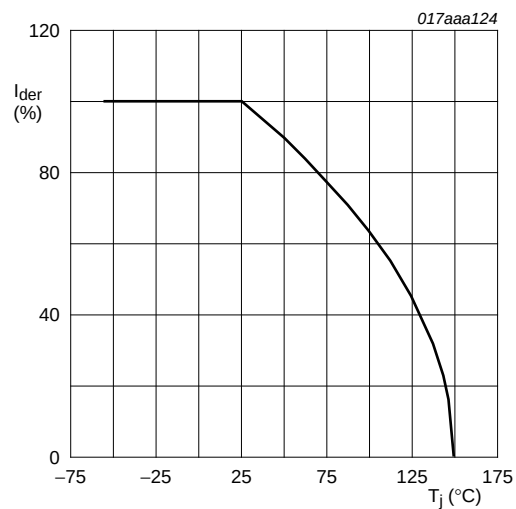
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm<sup>2</sup>.

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



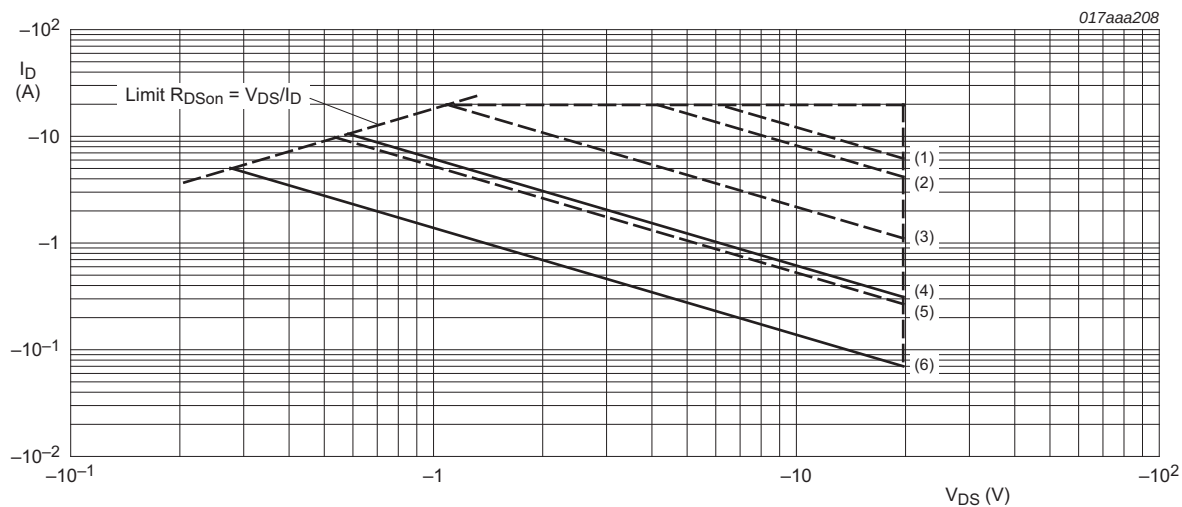
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}\text{C})}} \times 100 \%$$

**Fig 1. Normalized total power dissipation as a function of junction temperature**



$$I_{der} = \frac{I_D}{I_{D(25^{\circ}\text{C})}} \times 100 \%$$

**Fig 2. Normalized continuous drain current as a function of junction temperature**



$I_{DM}$  = single pulse

(1)  $t_p = 100 \mu\text{s}$

(2)  $t_p = 1 \text{ ms}$

(3)  $t_p = 10 \text{ ms}$

(4) DC;  $T_{sp} = 25^{\circ}\text{C}$

(5)  $t_p = 100 \text{ ms}$

(6) DC;  $T_{amb} = 25^{\circ}\text{C}$ ; drain mounting pad  $6 \text{ cm}^2$

**Fig 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage**

6. 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] | -   | 200   | 230 K/W |
|                |                                                  |             | [2] | -   | 78 90 | K/W     |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |             | -   | 15  | 20    | 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, mounting pad for drain 6 cm<sup>2</sup>.

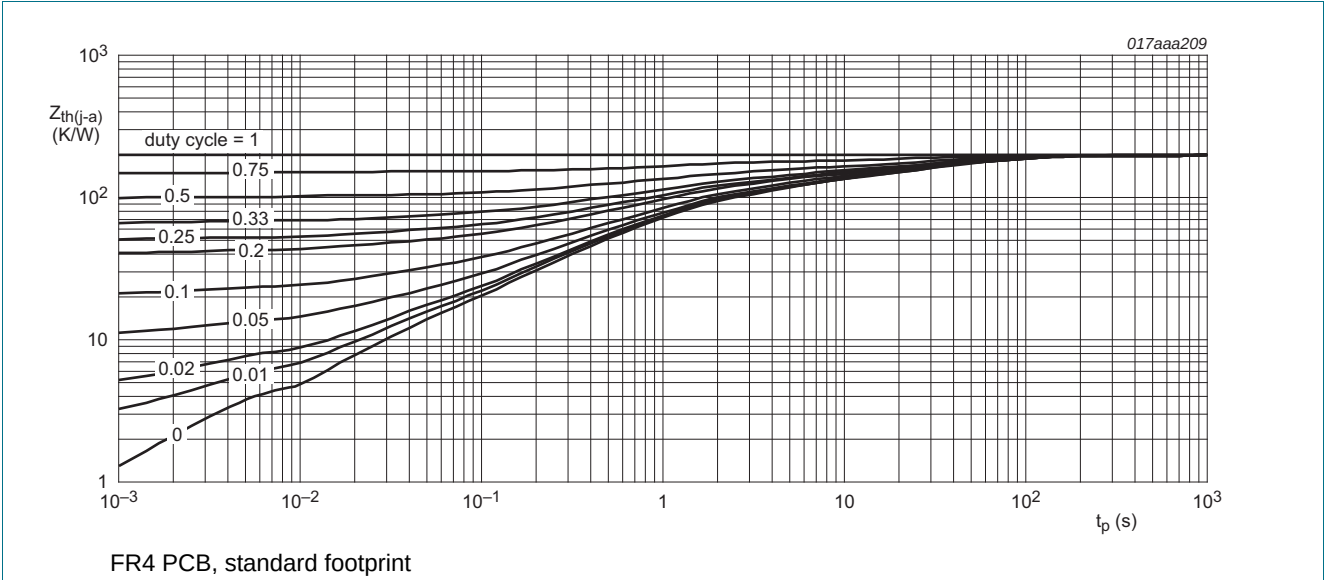


Fig 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

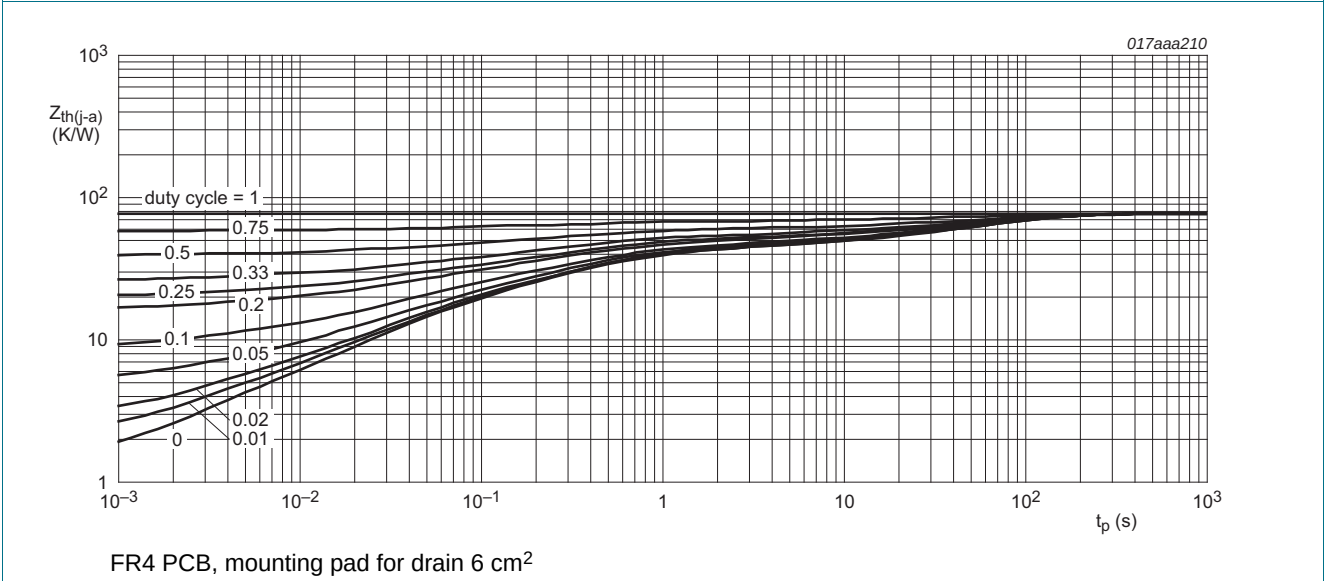


Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 7. 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                                                   | -20   | -     | -     | V    |
| V <sub>GSth</sub>       | gate-source threshold voltage    | I <sub>D</sub> = -250 μA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 25 °C                                      | -0.45 | -0.7  | -0.95 | V    |
| I <sub>DSS</sub>        | drain leakage current            | V <sub>DS</sub> = -20 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                    | -     | -     | -1    | μA   |
|                         |                                  | V <sub>DS</sub> = -20 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 150 °C                                                   | -     | -     | -10   | μA   |
| I <sub>GSS</sub>        | gate leakage current             | V <sub>GS</sub> = -8 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                     | -     | -     | -100  | nA   |
| R <sub>DSon</sub>       | drain-source on-state resistance | V <sub>GS</sub> = -4.5 V; I <sub>D</sub> = -2.4 A; T <sub>j</sub> = 25 °C                                                 | -     | 34    | 40    | mΩ   |
|                         |                                  | V <sub>GS</sub> = -4.5 V; I <sub>D</sub> = -2.4 A; T <sub>j</sub> = 150 °C                                                | -     | 48    | 55    | mΩ   |
|                         |                                  | V <sub>GS</sub> = -2.5 V; I <sub>D</sub> = -2.0 A; T <sub>j</sub> = 25 °C                                                 | -     | 42    | 48    | mΩ   |
|                         |                                  | V <sub>GS</sub> = -1.8 V; I <sub>D</sub> = -1.8 A; T <sub>j</sub> = 25 °C                                                 | -     | 57    | 66    | mΩ   |
| g <sub>fs</sub>         | forward transconductance         | V <sub>DS</sub> = -5 V; I <sub>D</sub> = -2.4 A; T <sub>j</sub> = 25 °C                                                   | -     | 13    | -     | S    |
| Dynamic characteristics |                                  |                                                                                                                           |       |       |       |      |
| Q <sub>G(tot)</sub>     | total gate charge                | V <sub>DS</sub> = -10 V; I <sub>D</sub> = -1 A; V <sub>GS</sub> = -4.5 V; T <sub>j</sub> = 25 °C                          | -     | 15.5  | 23    | nC   |
| Q <sub>GS</sub>         | gate-source charge               |                                                                                                                           | -     | 2.5   | -     | nC   |
| Q <sub>GD</sub>         | gate-drain charge                |                                                                                                                           | -     | 2     | -     | nC   |
| C <sub>iss</sub>        | input capacitance                | V <sub>DS</sub> = -10 V; f = 1 MHz; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                                         | -     | 1950  | -     | pF   |
| C <sub>oss</sub>        | output capacitance               |                                                                                                                           | -     | 175   | -     | pF   |
| C <sub>rss</sub>        | reverse transfer capacitance     |                                                                                                                           | -     | 105   | -     | pF   |
| t <sub>d(on)</sub>      | turn-on delay time               | V <sub>DS</sub> = -10 V; V <sub>GS</sub> = -5 V; R <sub>G(ext)</sub> = 6 Ω; T <sub>j</sub> = 25 °C; I <sub>D</sub> = -1 A | -     | 13    | -     | ns   |
| t <sub>r</sub>          | rise time                        |                                                                                                                           | -     | 21    | -     | ns   |
| t <sub>d(off)</sub>     | turn-off delay time              |                                                                                                                           | -     | 95    | -     | ns   |
| t <sub>f</sub>          | fall time                        |                                                                                                                           | -     | 33    | -     | ns   |
| Source-drain diode      |                                  |                                                                                                                           |       |       |       |      |
| V <sub>SD</sub>         | source-drain voltage             | I <sub>S</sub> = -2.4 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                    | -     | -0.75 | -1    | V    |

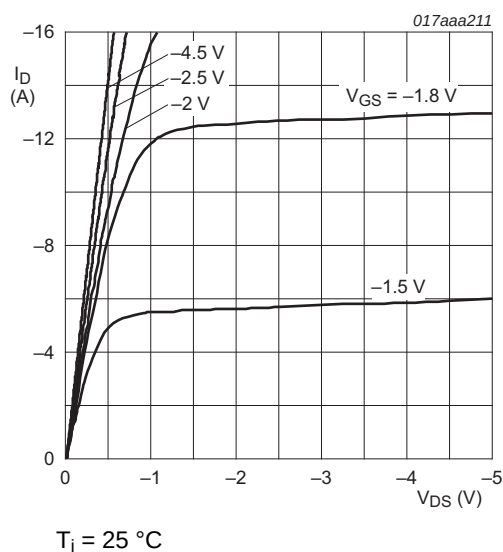


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values

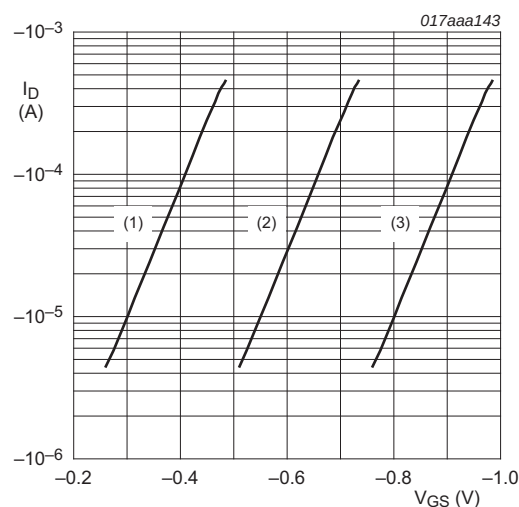


Fig 7. Sub-threshold drain current as a function of gate-source voltage

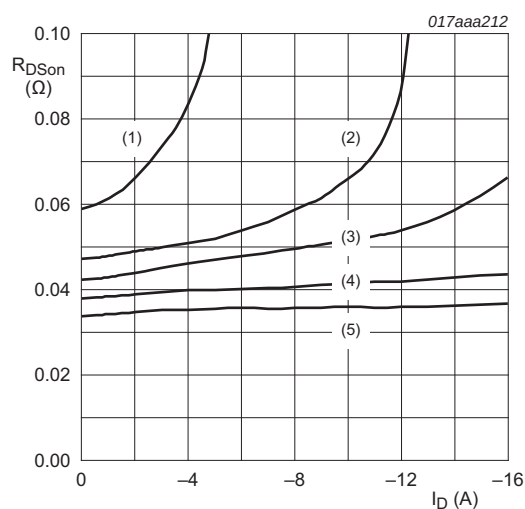


Fig 8. Drain-source on-state resistance as a function of drain current; typical values

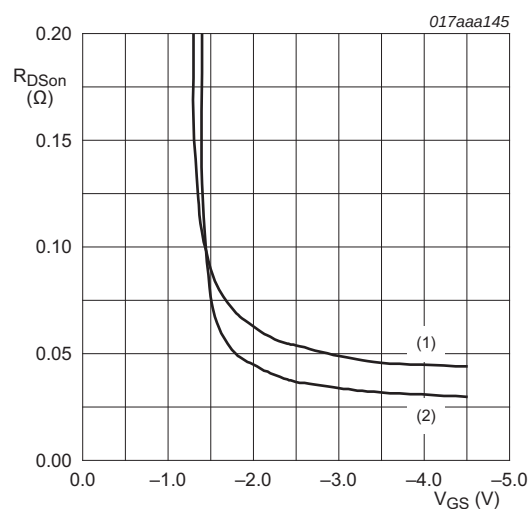
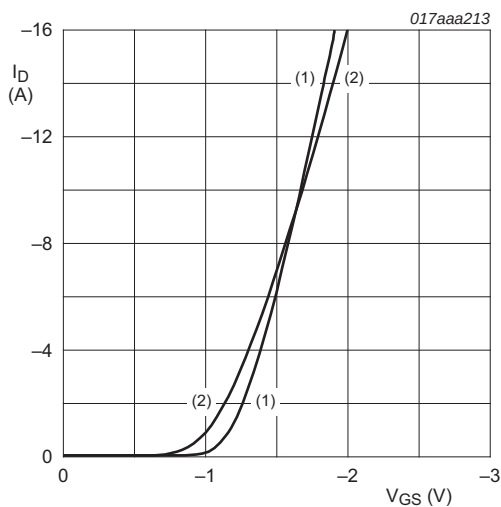
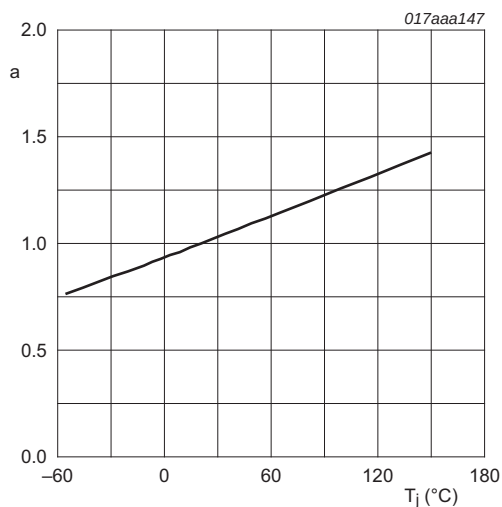


Fig 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



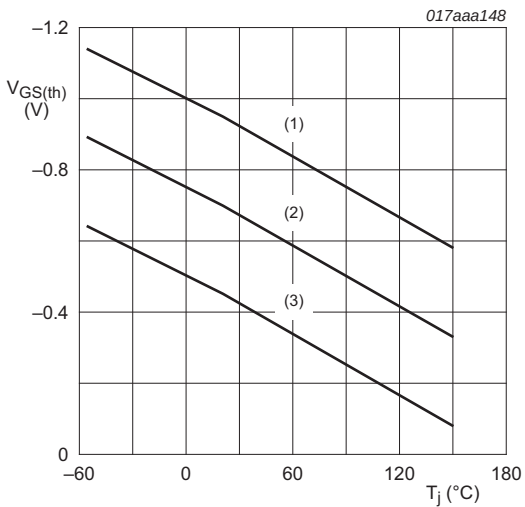
$V_{DS} > I_D \times R_{DSon}$   
(1)  $T_j = 25\text{ }^{\circ}\text{C}$   
(2)  $T_j = 150\text{ }^{\circ}\text{C}$

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



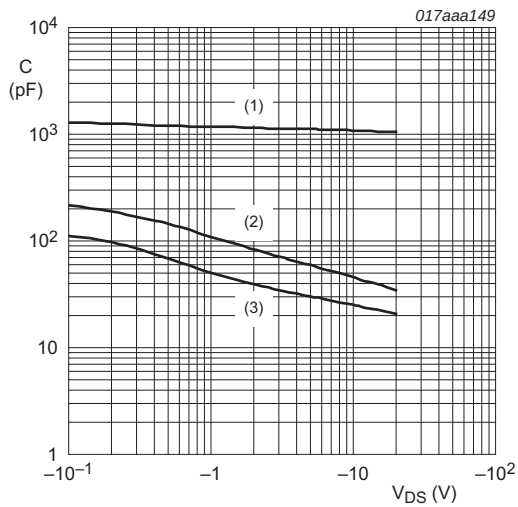
$$a = \frac{R_{DSon}}{R_{DSon(25^{\circ}\text{C})}}$$

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



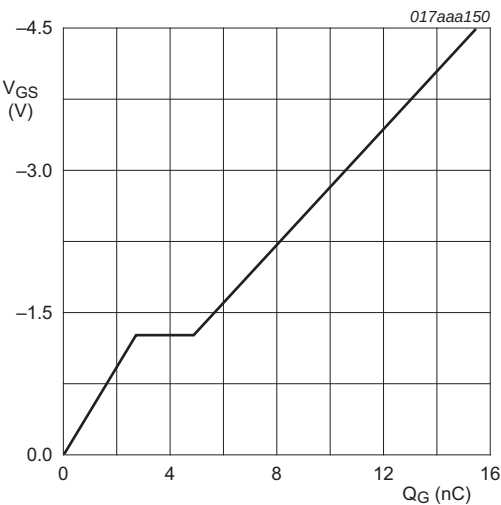
$I_D = -0.25\text{ mA}$ ;  $V_{DS} = V_{GS}$   
(1) maximum values  
(2) typical values  
(3) minimum values

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



$f = 1\text{ MHz}$ ;  $V_{GS} = 0\text{ V}$   
(1)  $C_{iss}$   
(2)  $C_{oss}$   
(3)  $C_{rss}$

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



$I_D = -2.4\text{ A}$ ;  $V_{DS} = -10\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$

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

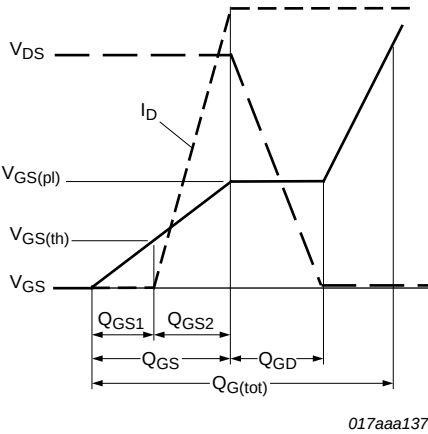
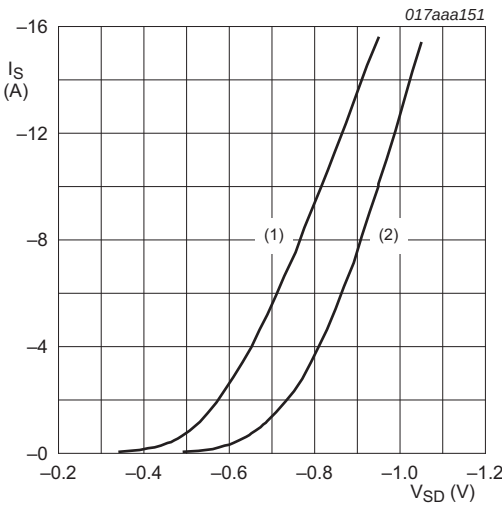


Fig 15. Gate charge waveform definitions



$V_{GS} = 0\text{ V}$   
(1)  $T_j = 150\text{ }^{\circ}\text{C}$   
(2)  $T_j = 25\text{ }^{\circ}\text{C}$

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



## 8. Test information

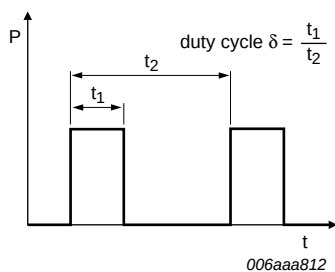


Fig 17. Duty cycle definition

9. Package outline

Plastic surface-mounted package (TSOP6); 6 leadsSOT457

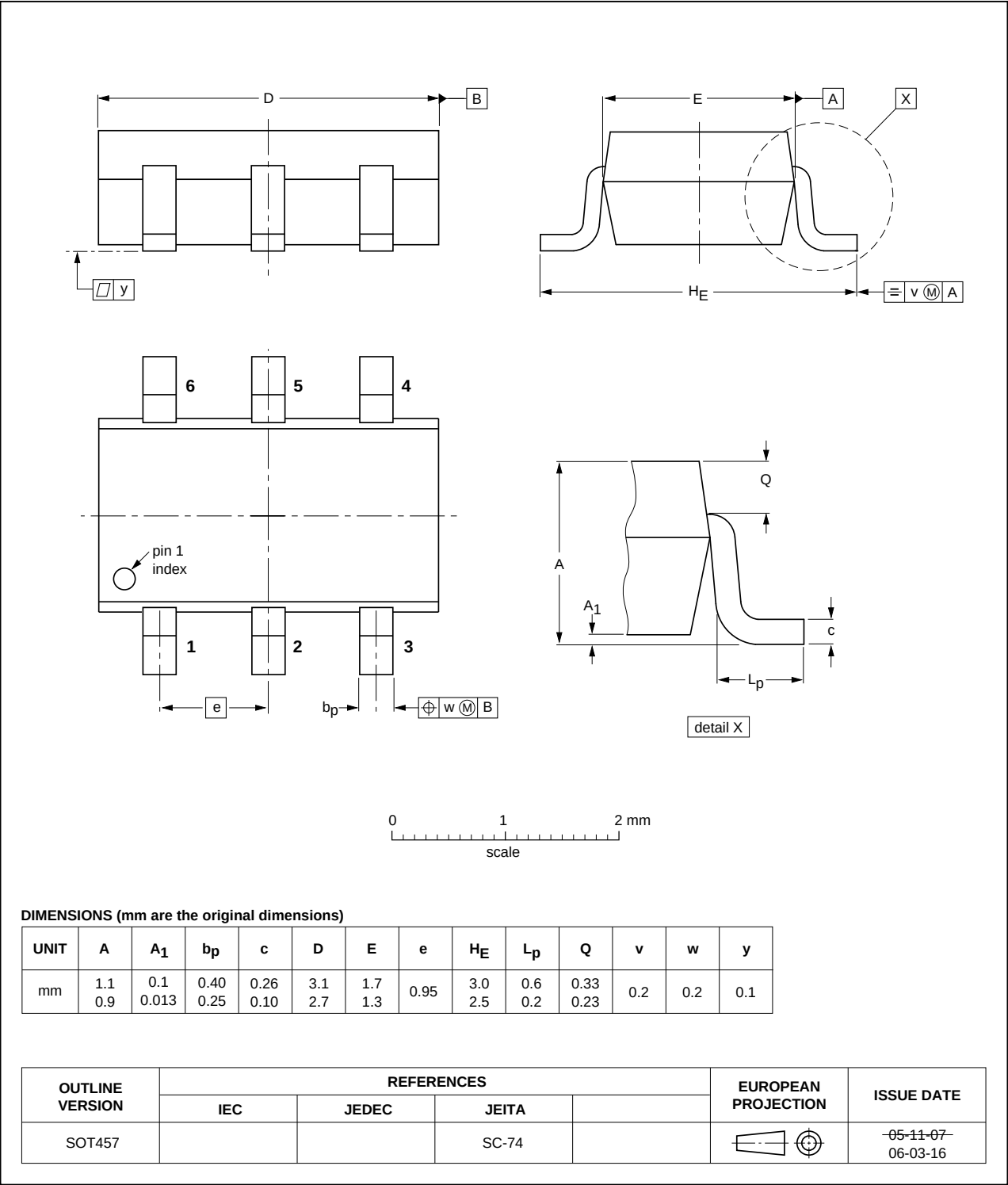


Fig 18. Package outline SOT457 (TSOP6)

10. Soldering

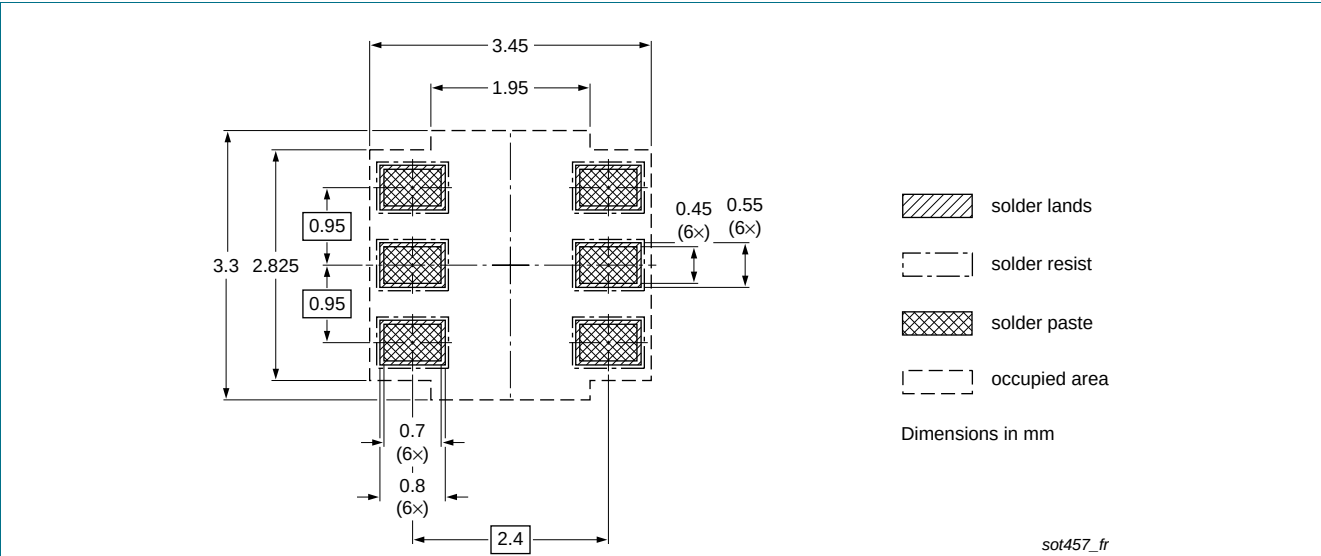


Fig 19. Reflow soldering footprint for SOT457 (TSOP6)

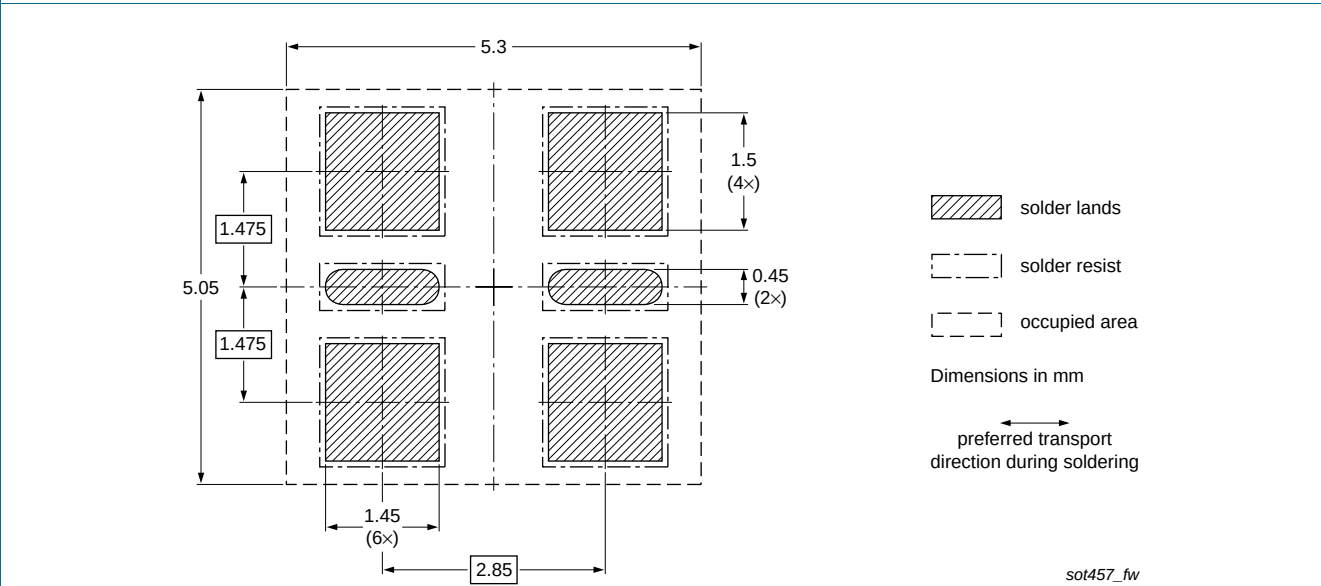


Fig 20. Wave soldering footprint for SOT457 (TSOP6)

## 11. Revision history

Table 8. Revision history

| Document ID | Release date | Data sheet status  | Change notice | Supersedes |
|-------------|--------------|--------------------|---------------|------------|
| PMN34UP v.1 | 20110509     | Product data sheet | -             | -          |

## 12. Legal information

### 12.1 Data sheet status

| Document status <sup>[1]</sup> <sup>[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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## 14. Contents

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|           |                                          |           |
|-----------|------------------------------------------|-----------|
| <b>1</b>  | <b>Product profile</b> . . . . .         | <b>1</b>  |
| 1.1       | General description . . . . .            | 1         |
| 1.2       | Features and benefits . . . . .          | 1         |
| 1.3       | Applications . . . . .                   | 1         |
| 1.4       | Quick reference data . . . . .           | 1         |
| <b>2</b>  | <b>Pinning information</b> . . . . .     | <b>1</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>4</b>  |
| <b>7</b>  | <b>Characteristics</b> . . . . .         | <b>5</b>  |
| <b>9</b>  | <b>Package outline</b> . . . . .         | <b>10</b> |
| <b>10</b> | <b>Soldering</b> . . . . .               | <b>11</b> |
| <b>11</b> | <b>Revision history</b> . . . . .        | <b>12</b> |
| <b>12</b> | <b>Legal information</b> . . . . .       | <b>13</b> |
| 12.1      | Data sheet status . . . . .              | 13        |
| 12.2      | Definitions . . . . .                    | 13        |
| 12.3      | Disclaimers . . . . .                    | 13        |
| 12.4      | Trademarks . . . . .                     | 14        |
| <b>13</b> | <b>Contact information</b> . . . . .     | <b>14</b> |

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