



# PMN42XPE

20 V, single P-channel Trench MOSFET

14 August 2012

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

- Fast switching
- Trench MOSFET technology
- 2 kV ESD protection

### 1.3 Applications

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

### 1.4 Quick reference data

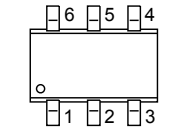
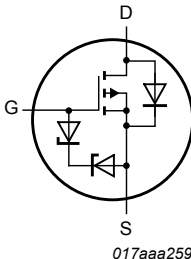
Table 1. Quick reference data

| Symbol                        | Parameter                        | Conditions                                                                |     | Min | Typ | Max  | Unit |
|-------------------------------|----------------------------------|---------------------------------------------------------------------------|-----|-----|-----|------|------|
| $V_{DS}$                      | drain-source voltage             | $T_J = 25\text{ °C}$                                                      |     | -   | -   | -20  | V    |
| $V_{GS}$                      | gate-source voltage              |                                                                           |     | -12 | -   | 12   | V    |
| $I_D$                         | drain current                    | $V_{GS} = -4.5\text{ V}$ ; $T_{amb} = 25\text{ °C}$ ; $t \leq 5\text{ s}$ | [1] | -   | -   | -5.7 | A    |
| <b>Static characteristics</b> |                                  |                                                                           |     |     |     |      |      |
| $R_{DS(on)}$                  | drain-source on-state resistance | $V_{GS} = -4.5\text{ V}$ ; $I_D = -3\text{ A}$ ; $T_J = 25\text{ °C}$     |     | -   | 41  | 46   | 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       | <br>TSOP6 (SOT457) | <br>017aaa259 |
| 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 |                                                  |         |
|-------------|---------|--------------------------------------------------|---------|
|             | Name    | Description                                      | Version |
| PMN42XPE    | TSOP6   | plastic surface-mounted package (TSOP6); 6 leads | SOT457  |

## 4. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PMN42XPE    | WE           |

## 5. Limiting values

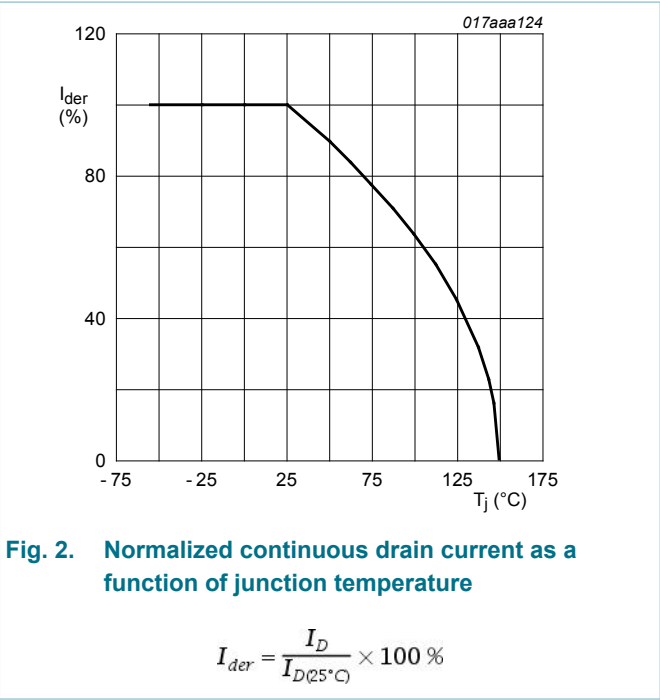
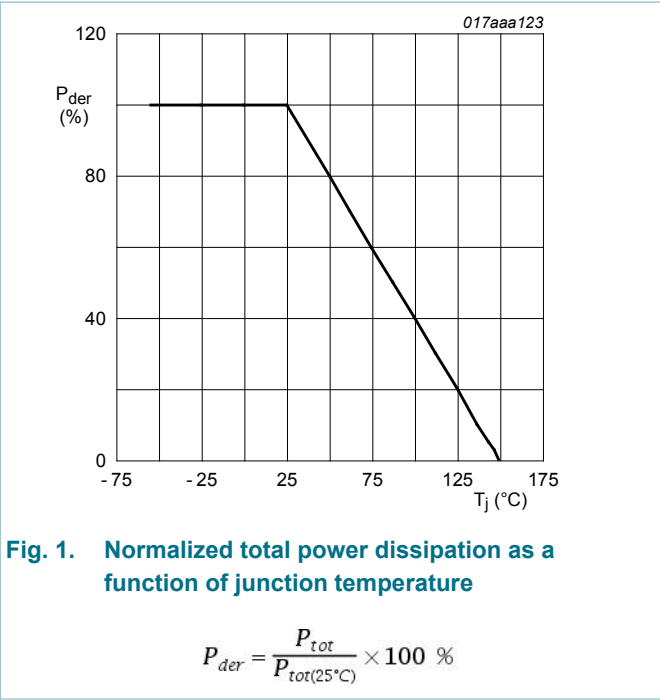
Table 5. Limiting values

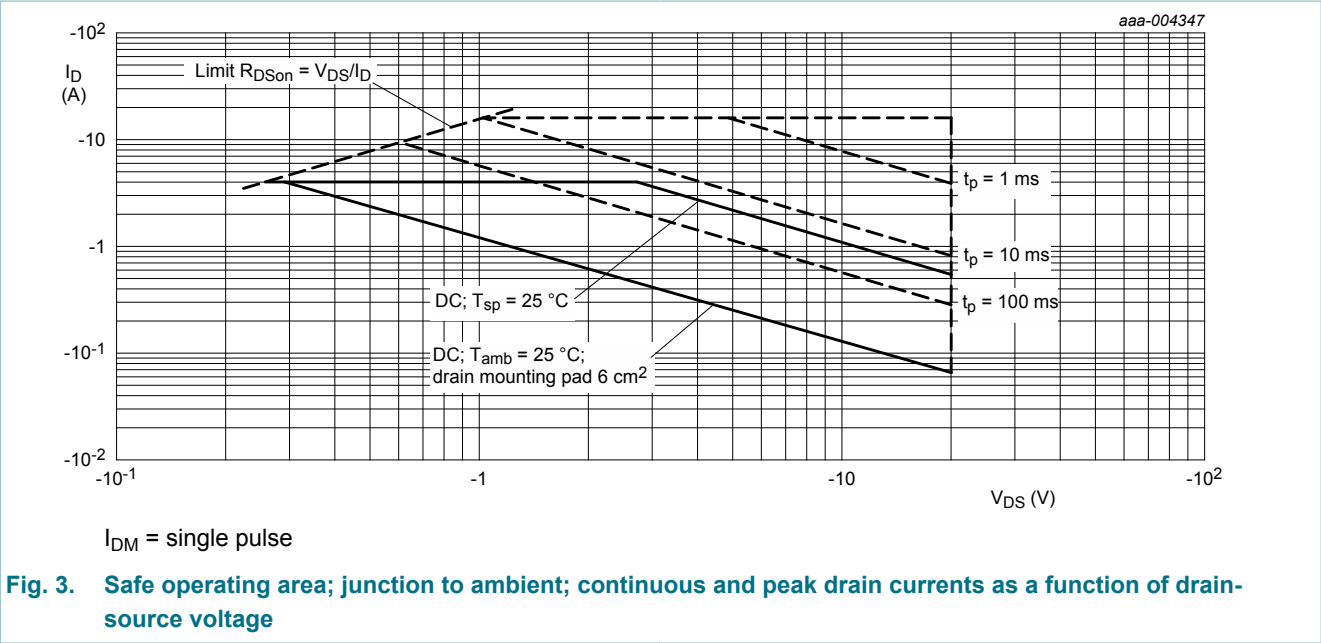
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol    | Parameter               | Conditions                                                                    |     | Min | Max  | Unit |
|-----------|-------------------------|-------------------------------------------------------------------------------|-----|-----|------|------|
| $V_{DS}$  | drain-source voltage    | $T_j = 25\text{ °C}$                                                          |     | -   | -20  | V    |
| $V_{GS}$  | gate-source voltage     |                                                                               |     | -12 | 12   | V    |
| $I_D$     | drain current           | $V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ °C}; t \leq 5\text{ s}$           | [1] | -   | -5.7 | A    |
|           |                         | $V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ °C}$                              | [1] | -   | -4   | A    |
|           |                         | $V_{GS} = -4.5\text{ V}; T_{amb} = 100\text{ °C}$                             | [1] | -   | -2.9 | A    |
| $I_{DM}$  | peak drain current      | $T_{amb} = 25\text{ °C}; \text{single pulse}; t_p \leq 10\text{ }\mu\text{s}$ |     | -   | -16  | A    |
| $P_{tot}$ | total power dissipation | $T_{amb} = 25\text{ °C}$                                                      | [2] | -   | 500  | mW   |
|           |                         |                                                                               | [1] | -   | 1310 | mW   |
|           |                         | $T_{sp} = 25\text{ °C}$                                                       |     | -   | 8330 | mW   |

| Symbol             | Parameter                       | Conditions               |     | Min | Max  | Unit |
|--------------------|---------------------------------|--------------------------|-----|-----|------|------|
| T <sub>j</sub>     | junction temperature            |                          |     | -55 | 150  | °C   |
| T <sub>amb</sub>   | ambient temperature             |                          |     | -55 | 150  | °C   |
| T <sub>stg</sub>   | storage temperature             |                          |     | -65 | 150  | °C   |
| Source-drain diode |                                 |                          |     |     |      |      |
| I <sub>S</sub>     | source current                  | T <sub>amb</sub> = 25 °C | [1] | -   | -1.4 | A    |
| ESD maximum rating |                                 |                          |     |     |      |      |
| V <sub>ESD</sub>   | electrostatic discharge voltage | HBM                      | [3] | -   | 2000 | V    |

- [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.
- [3] Measured between all pins.



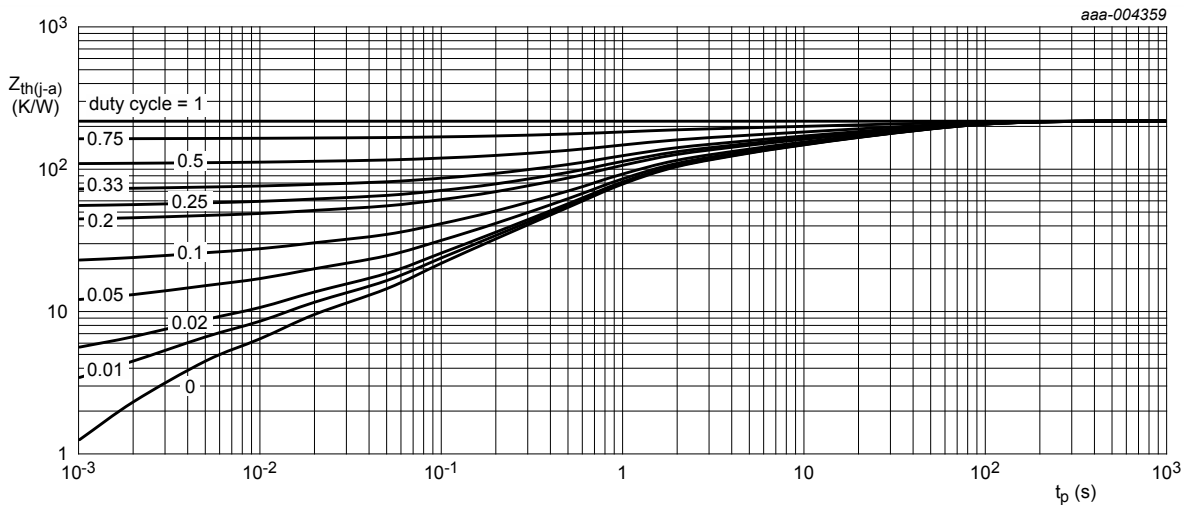


6. Thermal characteristics

Table 6. Thermal characteristics

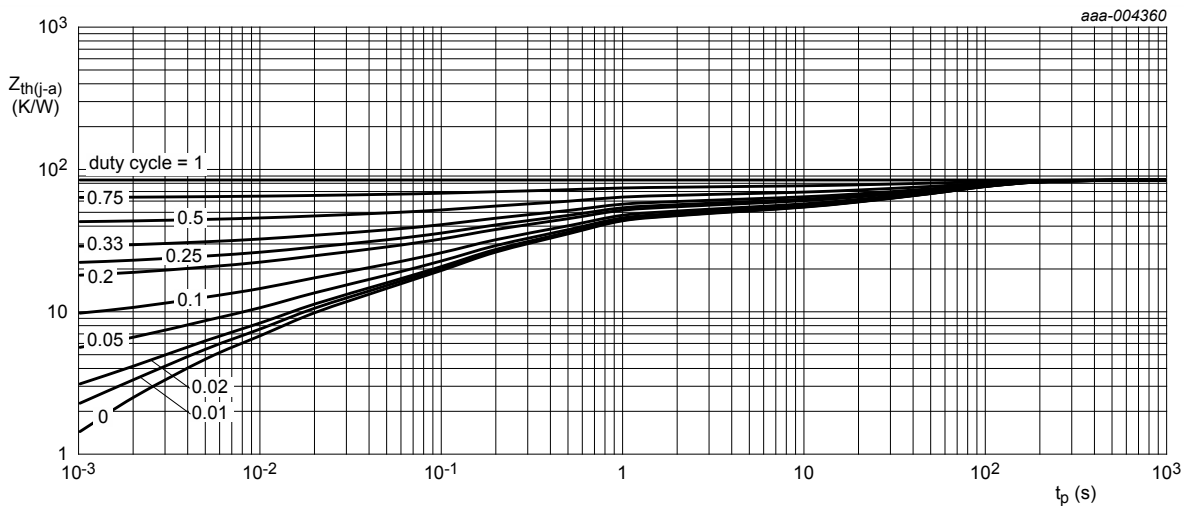
| Symbol         | Parameter                                        | Conditions                       |     | Min | Typ | Max | Unit |
|----------------|--------------------------------------------------|----------------------------------|-----|-----|-----|-----|------|
| $R_{th(j-a)}$  | thermal resistance from junction to ambient      | in free air                      | [1] | -   | 216 | 250 | K/W  |
|                |                                                  |                                  | [2] | -   | 83  | 95  | K/W  |
|                |                                                  | in free air; $t \leq 5\text{ s}$ | [2] | -   | 51  | 60  | K/W  |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |                                  |     | -   | 10  | 15  | 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  $6\text{ cm}^2$ .



FR4 PCB, standard footprint

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



FR4 PCB, mounting pad for drain 6 cm<sup>2</sup>

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 |                                |                                                                                            |       |     |       |               |
| $V_{(BR)DSS}$          | drain-source breakdown voltage | $I_D = -250\text{ }\mu\text{A}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ | -20   | -   | -     | V             |
| $V_{GSth}$             | gate-source threshold voltage  | $I_D = -250\text{ }\mu\text{A}$ ; $V_{DS} = V_{GS}$ ; $T_j = 25\text{ }^\circ\text{C}$     | -0.75 | -1  | -1.25 | V             |
| $I_{DSS}$              | drain leakage current          | $V_{DS} = -20\text{ V}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$         | -     | -   | -1    | $\mu\text{A}$ |
|                        |                                | $V_{DS} = -20\text{ V}$ ; $V_{GS} = 0\text{ V}$ ; $T_{amb} = 150\text{ }^\circ\text{C}$    | -     | -   | -10   | $\mu\text{A}$ |

| Symbol                  | Parameter                        | Conditions                                                                                                                  |  | Min | Typ  | Max  | Unit |
|-------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------|--|-----|------|------|------|
| I <sub>GSS</sub>        | gate leakage current             | V <sub>GS</sub> = 12 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                       |  | -   | -    | -10  | μA   |
|                         |                                  | V <sub>GS</sub> = -12 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                      |  | -   | -    | -10  | μA   |
| R <sub>DSon</sub>       | drain-source on-state resistance | V <sub>GS</sub> = -4.5 V; I <sub>D</sub> = -3 A; T <sub>j</sub> = 25 °C                                                     |  | -   | 41   | 46   | mΩ   |
|                         |                                  | V <sub>GS</sub> = -4.5 V; I <sub>D</sub> = -3 A; T <sub>j</sub> = 150 °C                                                    |  | -   | 56   | 64   | mΩ   |
|                         |                                  | V <sub>GS</sub> = -2.5 V; I <sub>D</sub> = -3 A; T <sub>j</sub> = 25 °C                                                     |  | -   | 56   | 64   | mΩ   |
| g <sub>fs</sub>         | forward transconductance         | V <sub>DS</sub> = -10 V; I <sub>D</sub> = -4 A; T <sub>j</sub> = 25 °C                                                      |  | -   | 12.5 | -    | S    |
| Dynamic characteristics |                                  |                                                                                                                             |  |     |      |      |      |
| Q <sub>G(tot)</sub>     | total gate charge                | V <sub>DS</sub> = -10 V; I <sub>D</sub> = -4 A; V <sub>GS</sub> = -4.5 V; T <sub>j</sub> = 25 °C                            |  | -   | 11.5 | 17.3 | nC   |
| Q <sub>GS</sub>         | gate-source charge               |                                                                                                                             |  | -   | 2.7  | -    | nC   |
| Q <sub>GD</sub>         | gate-drain charge                |                                                                                                                             |  | -   | 2.4  | -    | 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                                           |  | -   | 1410 | -    | pF   |
| C <sub>oss</sub>        | output capacitance               |                                                                                                                             |  | -   | 207  | -    | pF   |
| C <sub>rss</sub>        | reverse transfer capacitance     |                                                                                                                             |  | -   | 148  | -    | pF   |
| t <sub>d(on)</sub>      | turn-on delay time               | V <sub>DS</sub> = -10 V; I <sub>D</sub> = -4 A; V <sub>GS</sub> = -4.5 V; R <sub>G(ext)</sub> = 6 Ω; T <sub>j</sub> = 25 °C |  | -   | 17   | -    | ns   |
| t <sub>r</sub>          | rise time                        |                                                                                                                             |  | -   | 27   | -    | ns   |
| t <sub>d(off)</sub>     | turn-off delay time              |                                                                                                                             |  | -   | 33   | -    | ns   |
| t <sub>f</sub>          | fall time                        |                                                                                                                             |  | -   | 27   | -    | ns   |
| Source-drain diode      |                                  |                                                                                                                             |  |     |      |      |      |
| V <sub>SD</sub>         | source-drain voltage             | I <sub>S</sub> = -1.2 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                      |  | -   | -0.7 | -1.2 | V    |

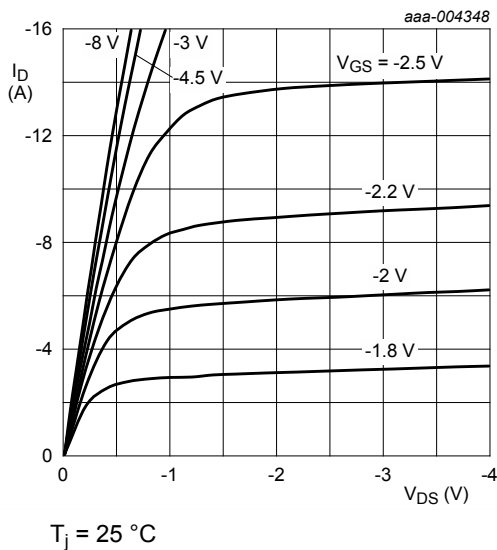


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

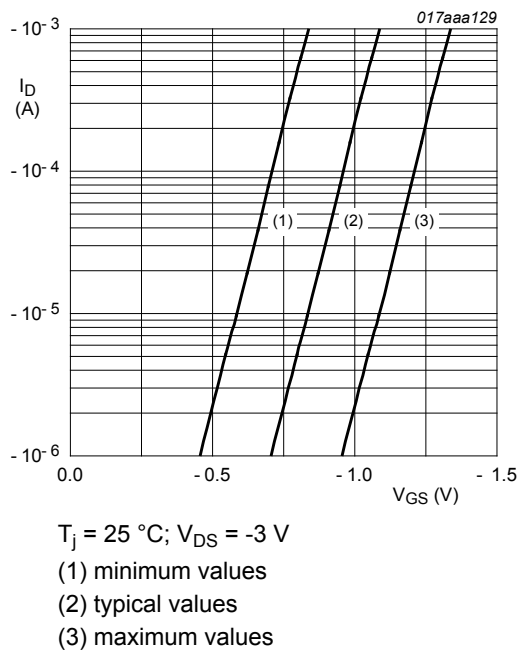


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

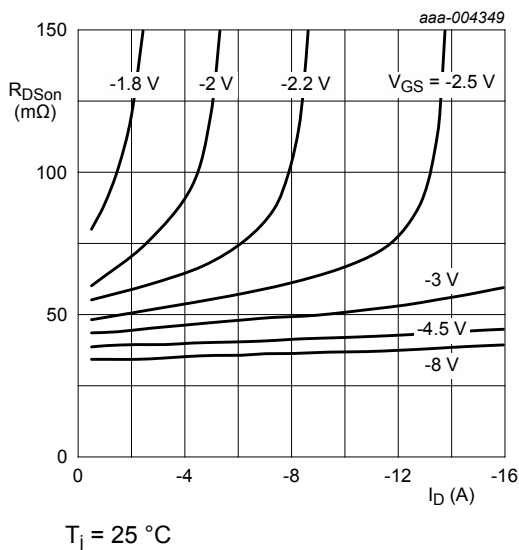


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

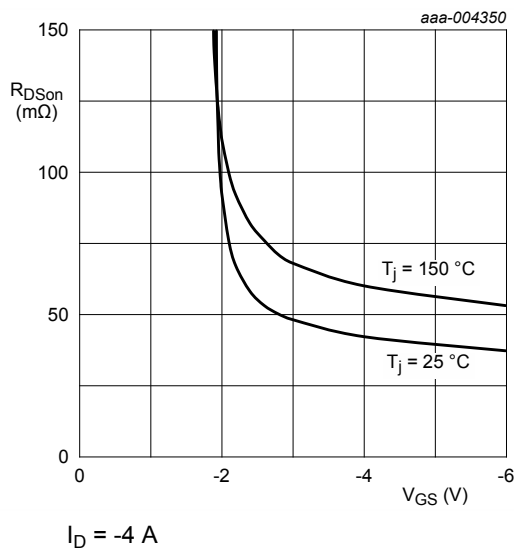


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

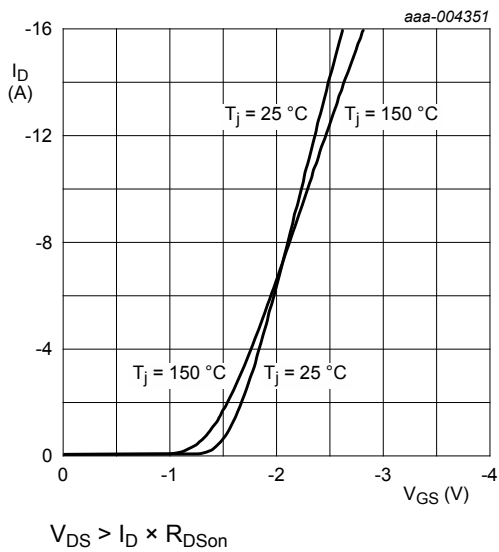


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

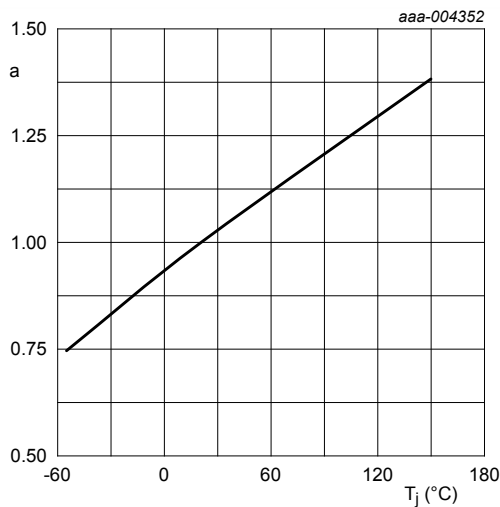


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

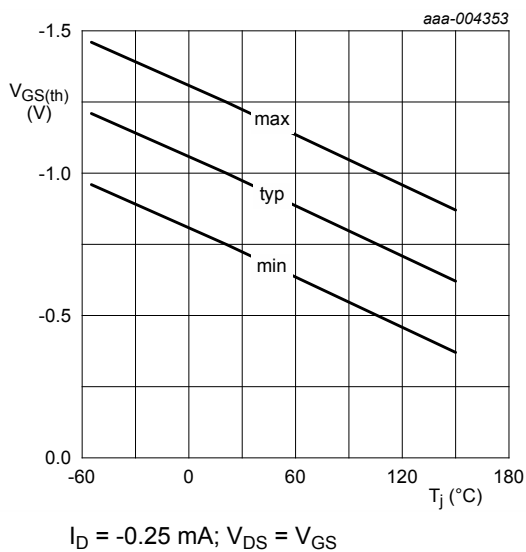


Fig. 12. Gate-source threshold voltage as a function of junction temperature

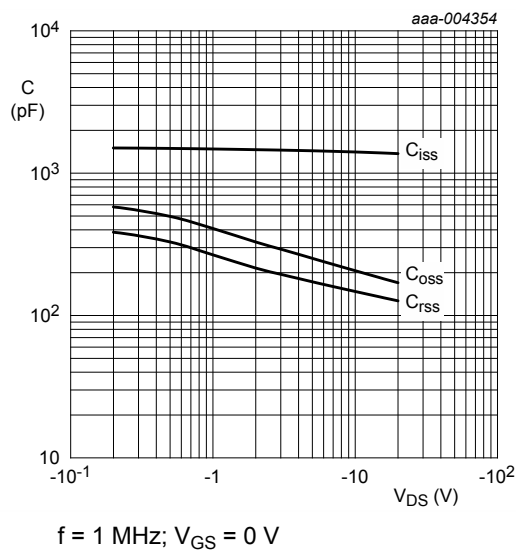


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



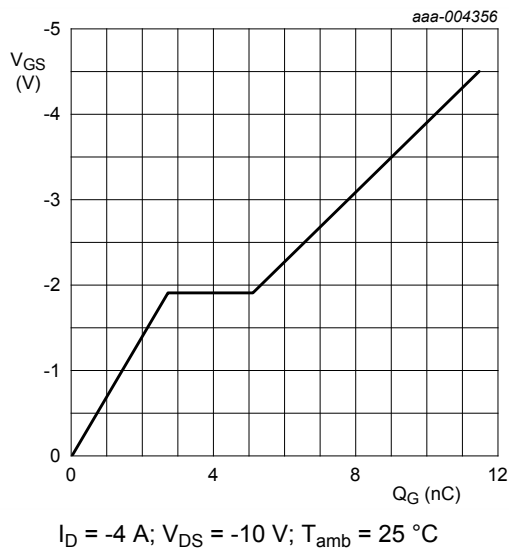


Fig. 14. Gate-source voltage as a function of gate charge; typical values

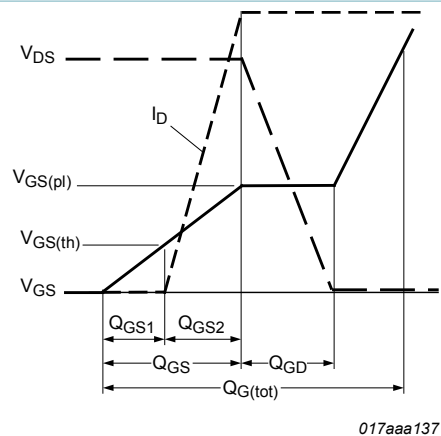


Fig. 15. Gate charge waveform definitions

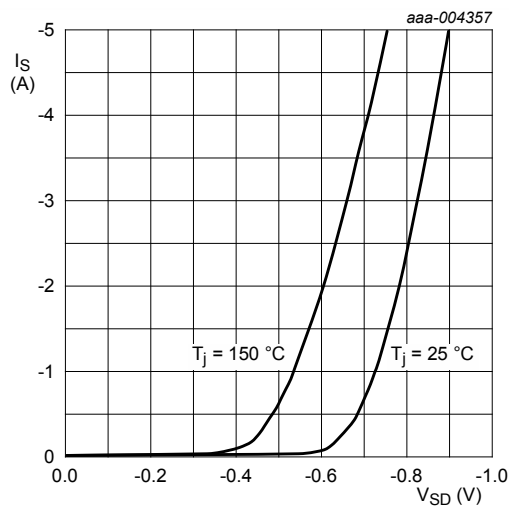


Fig. 16. Source current as a function of source-drain voltage; typical values

8. Test information

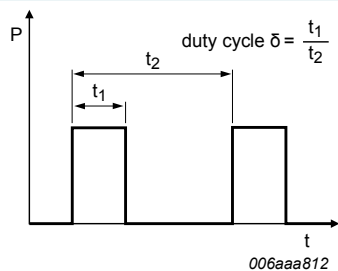
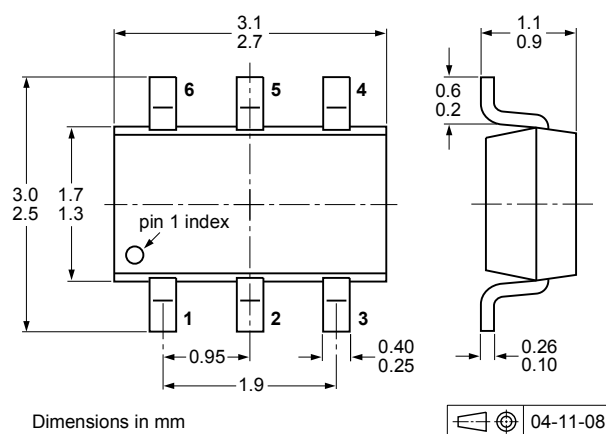


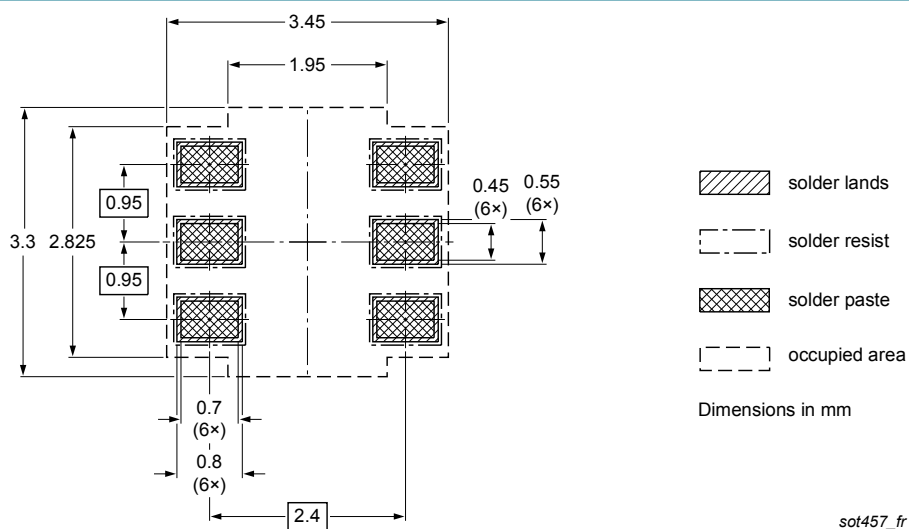
Fig. 17. Duty cycle definition

## 9. Package outline

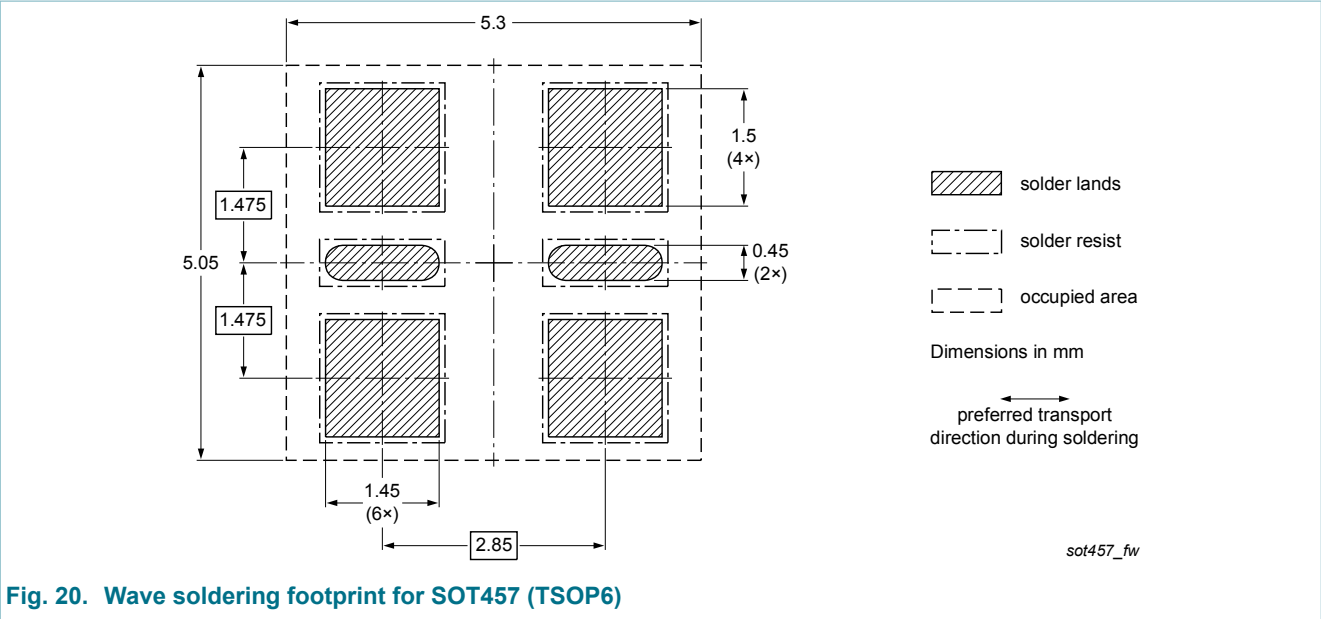


**Fig. 18. TSOP6 (SOT457)**

## 10. Soldering



**Fig. 19. Reflow soldering footprint for SOT457 (TSOP6)**



## 11. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status  | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| PMN42XPE v.1  | 20120814     | Product data sheet | -             | -          |

## 12. Legal information

### 12.1 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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