



PMN70EPE

30 V, P-channel Trench MOSFET

23 May 2017

Product data sheet

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.

2. Features and benefits

- Trench MOSFET technology
- Logic-level compatible
- Very fast switching
- Enhanced power dissipation capability of 1.4 W
- ElectroStatic Discharge (ESD) protection > 2 kV HBM

3. Applications

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

4. Quick reference data

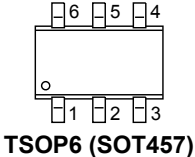
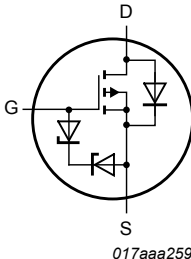
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------|----------------------------------|--|-----|-----|------|------|
| V_{DS} | drain-source voltage | $T_j = 25\text{ °C}$ | - | - | -30 | V |
| V_{GS} | gate-source voltage | | -20 | - | 20 | V |
| I_D | drain current | $V_{GS} = -10\text{ V}; T_{amb} = 25\text{ °C}; t \leq 5\text{ s}$ | [1] | - | -4.4 | A |
| Static characteristics | | | | | | |
| R_{DSon} | drain-source on-state resistance | $V_{GS} = -10\text{ V}; I_D = -3.3\text{ A}; T_j = 25\text{ °C}$ | - | 60 | 80 | mΩ |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm².

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------|---|--|
| 1 | D | drain |  <p>TSOP6 (SOT457)</p> |  <p>017aaa259</p> |
| 2 | D | drain | | |
| 3 | G | gate | | |
| 4 | S | source | | |
| 5 | D | drain | | |
| 6 | D | drain | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|---------|--|---------|
| | Name | Description | Version |
| PMN70EPE | TSOP6 | plastic surface-mounted package (TSOP6); 6 leads | SOT457 |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PMN70EPE | G2 |

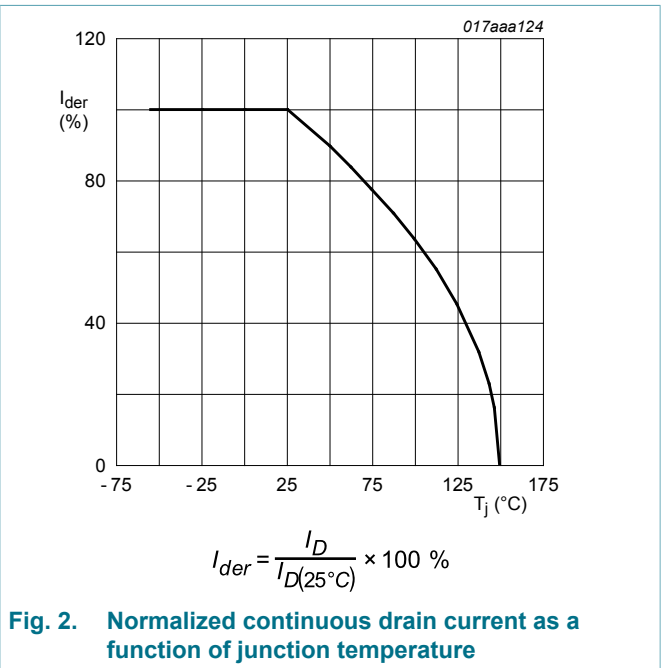
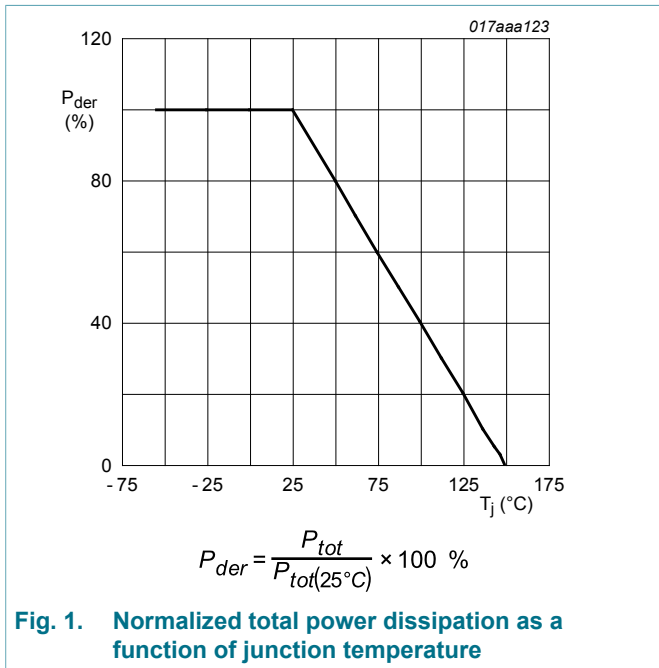
8. Limiting values

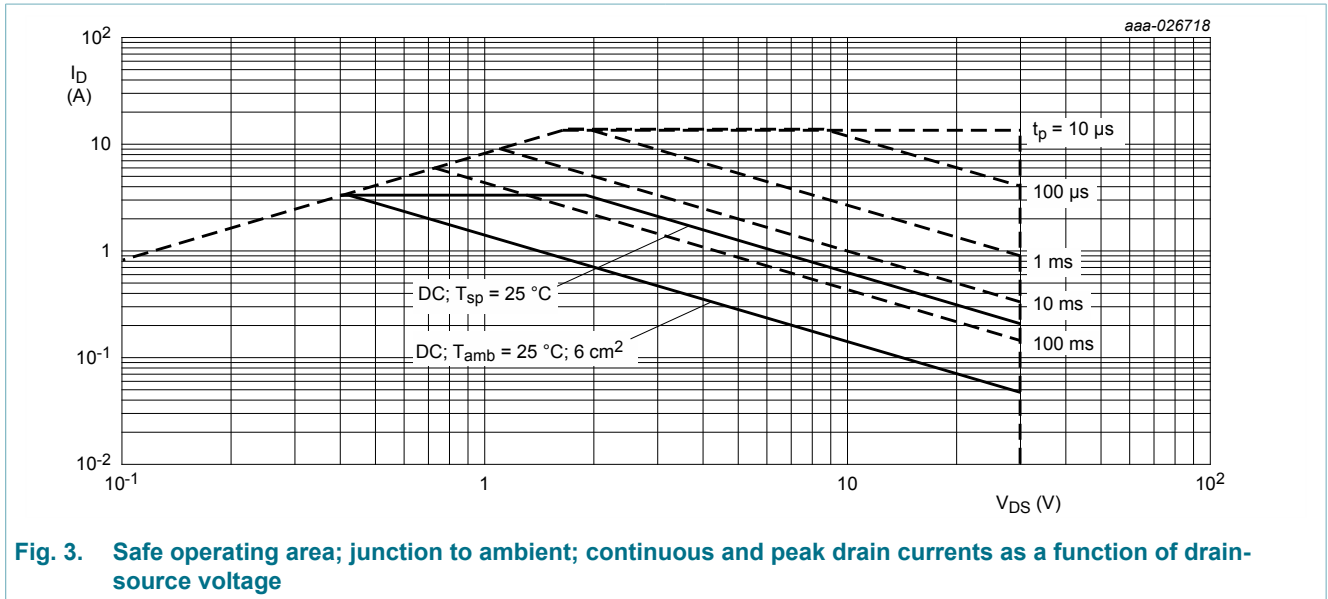
Table 5. Limiting values

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

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---------------------------|-------------------------|--|-----|-----|------|------|
| V _{DS} | drain-source voltage | T _j = 25 °C | | - | -30 | V |
| V _{GS} | gate-source voltage | | | -20 | 20 | V |
| I _D | drain current | V _{GS} = -10 V; T _{amb} = 25 °C; t ≤ 5 s | [1] | - | -4.4 | A |
| | | V _{GS} = -10 V; T _{amb} = 25 °C | [1] | - | -3.3 | A |
| | | V _{GS} = -10 V; T _{amb} = 100 °C | [1] | - | -2.1 | A |
| I _{DM} | peak drain current | T _{amb} = 25 °C; single pulse; t _p ≤ 10 μs | | - | -14 | A |
| P _{tot} | total power dissipation | T _{amb} = 25 °C | [2] | - | 570 | mW |
| | | | [1] | - | 1.4 | W |
| | | T _{sp} = 25 °C | | - | 6.25 | W |
| T _j | junction temperature | | | -55 | 150 | °C |
| T _{amb} | ambient temperature | | | -55 | 150 | °C |
| T _{stg} | storage temperature | | | -65 | 150 | °C |
| Source-drain diode | | | | | | |
| I _S | source current | T _{amb} = 25 °C | [1] | - | -1.4 | A |

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm².
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.





9. 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] | - | 190 | 220 | K/W |
| | | | [2] | - | 78 | 90 | K/W |
| | | in free air; t ≤ 5 s | [2] | - | 47 | 54 | 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 cm².

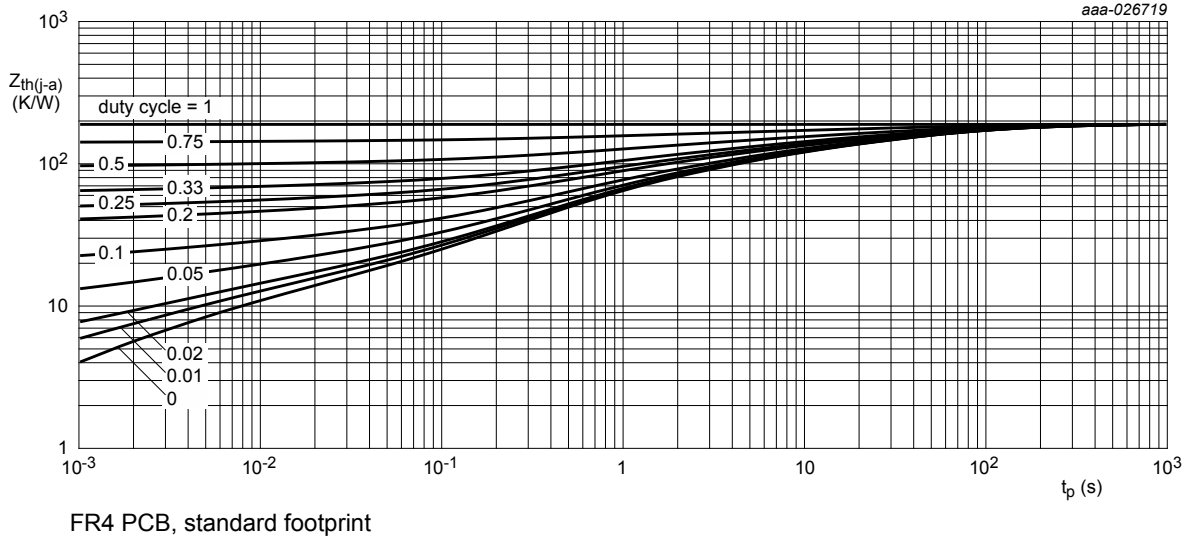


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

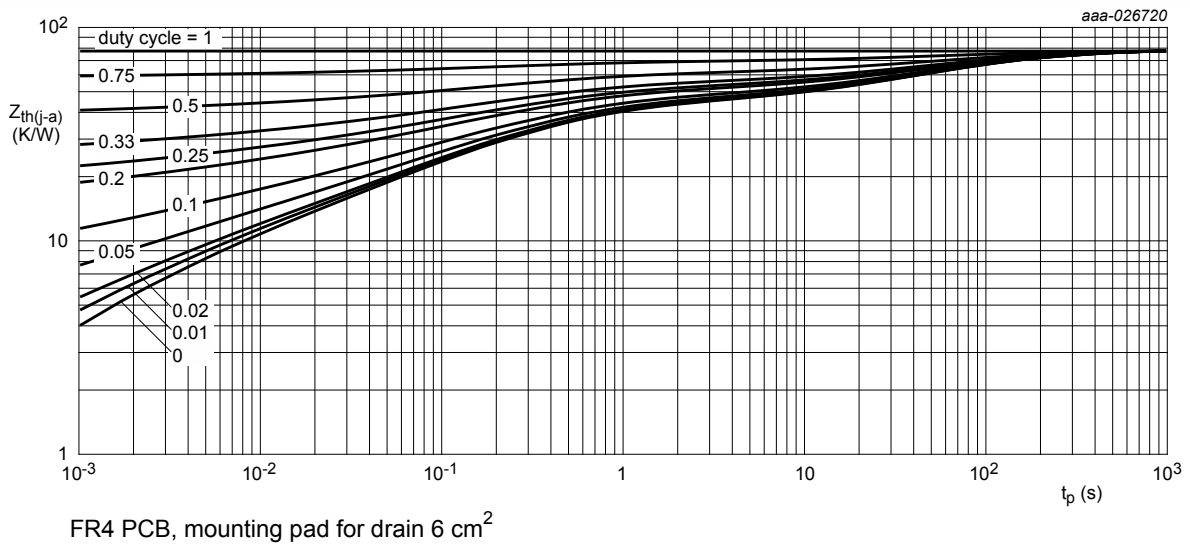


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|---|---|------|------|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = -250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | -30 | - | - | V |
| V_{GSth} | gate-source threshold voltage | $I_D = -250 \mu\text{A}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C}$ | -1 | -2 | -3 | V |
| I_{DSS} | drain leakage current | $V_{DS} = -30 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | - | -1 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | - | 10 | μA |
| | | $V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | - | -10 | μA |
| | | $V_{GS} = 10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | - | 1 | μA |
| | | $V_{GS} = -10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | - | -1 | μA |
| | | $V_{GS} = 4.5 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | - | 100 | nA |
| | | $V_{GS} = -4.5 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | - | -100 | nA |
| R_{DSon} | drain-source on-state resistance | $V_{GS} = -10 \text{ V}; I_D = -3.3 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ | - | 60 | 80 | m Ω |
| | | $V_{GS} = -10 \text{ V}; I_D = -3.3 \text{ A}; T_j = 150 \text{ }^\circ\text{C}$ | - | 91 | 121 | m Ω |
| | | $V_{GS} = -4.5 \text{ V}; I_D = -2.6 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ | - | 96 | 140 | m Ω |
| g_{fs} | forward transconductance | $V_{DS} = -10 \text{ V}; I_D = -2 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ | - | 12.6 | - | S |
| R_G | gate resistance | $f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}$ | - | 12 | - | Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $V_{DS} = -15 \text{ V}; I_D = -3.3 \text{ A}; V_{GS} = -10 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 6.5 | 11.5 | nC |
| Q_{GS} | gate-source charge | | - | 1.2 | - | nC |
| Q_{GD} | gate-drain charge | | - | 1.2 | - | nC |
| C_{iss} | input capacitance | $V_{DS} = -15 \text{ V}; f = 1 \text{ MHz}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 370 | - | pF |
| C_{oss} | output capacitance | | - | 64 | - | pF |
| C_{rss} | reverse transfer capacitance | | - | 44 | - | pF |
| $t_{d(on)}$ | turn-on delay time | | $V_{DS} = -15 \text{ V}; I_D = -3.3 \text{ A}; V_{GS} = -10 \text{ V}; R_{G(ext)} = 6 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$ | - | 5 | - |
| t_r | rise time | - | | 8 | - | ns |
| $t_{d(off)}$ | turn-off delay time | - | | 19 | - | ns |
| t_f | fall time | - | | 7.5 | - | ns |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = -1.4 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | -0.8 | -1.2 | V |

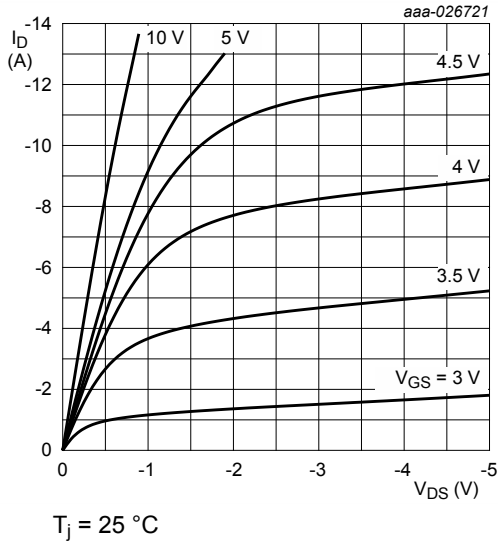


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

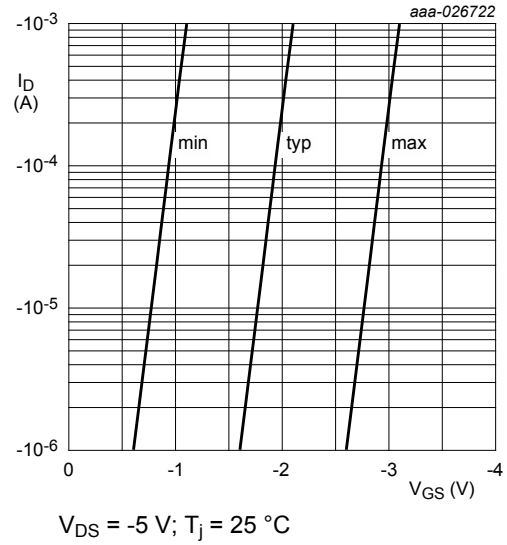


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

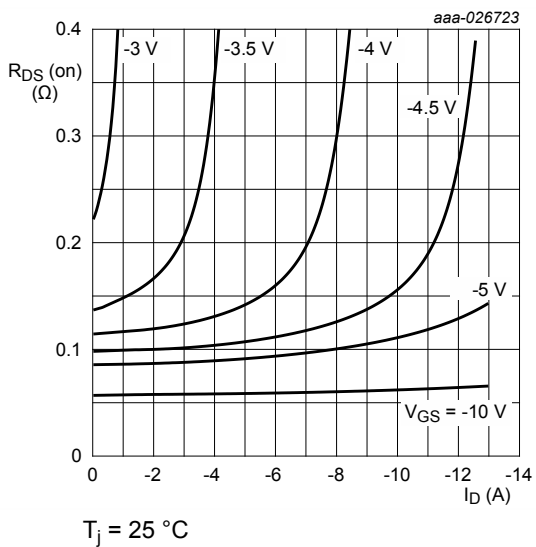


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

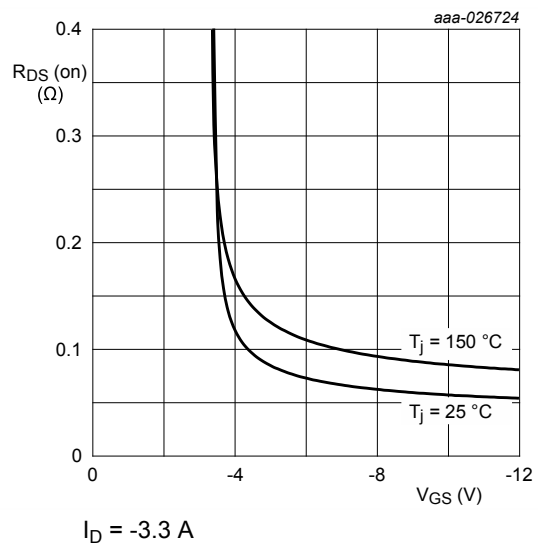
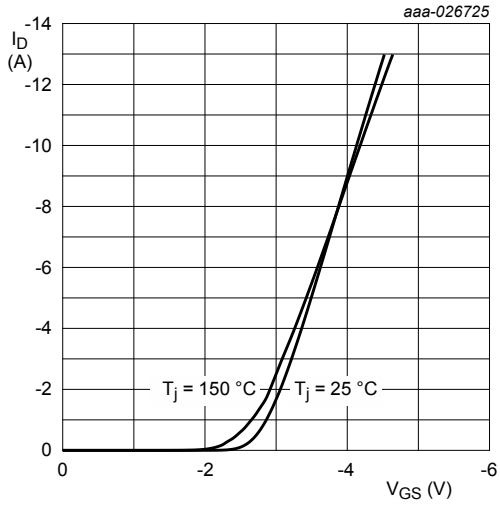
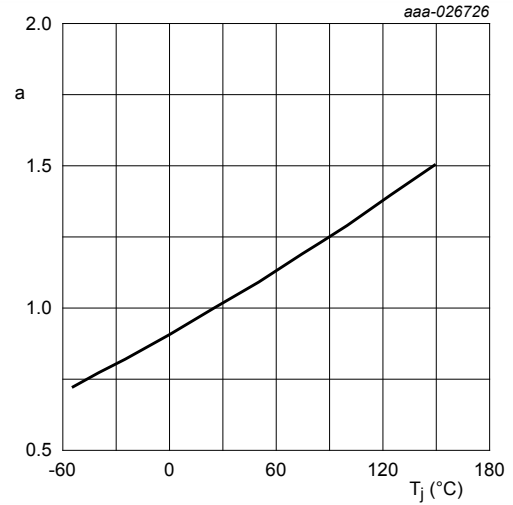


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



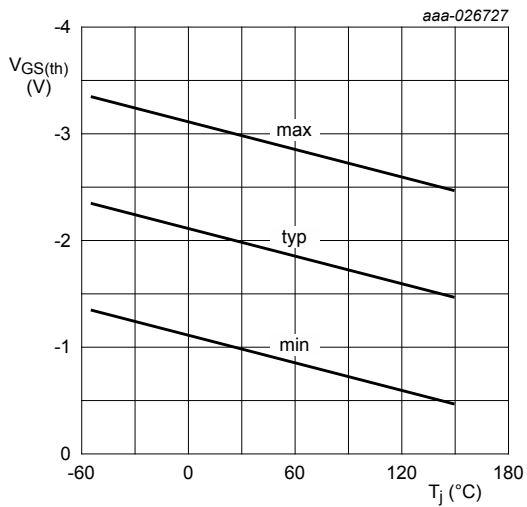
$$V_{DS} > I_D \times R_{DSon}$$

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



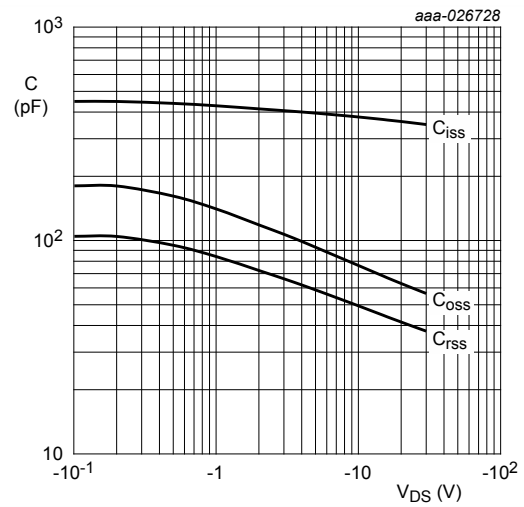
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ C)}}$$

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



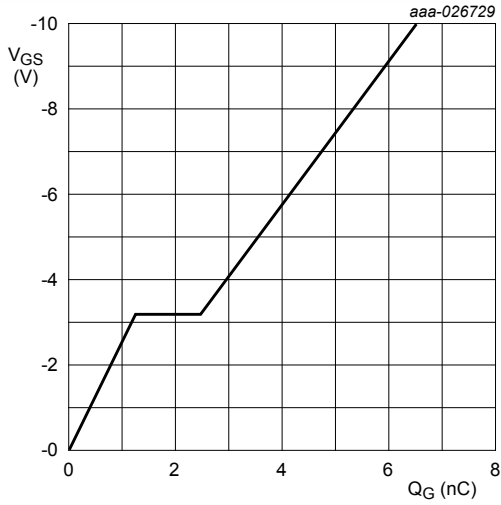
$$I_D = -250 \mu A; V_{DS} = V_{GS}$$

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



$$f = 1 \text{ MHz}; V_{GS} = 0 \text{ V}$$

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



$V_{DS} = -15\text{ V}; I_D = -3.3\text{ A}; T_j = 25\text{ }^\circ\text{C}$

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

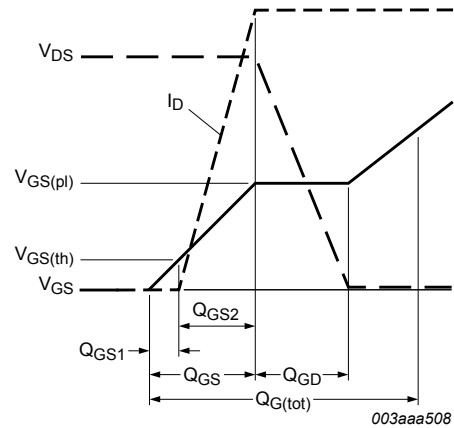
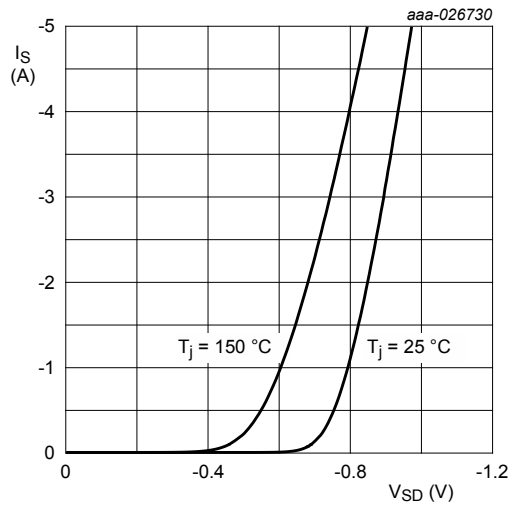


Fig. 15. Gate charge waveform definitions



$V_{GS} = 0\text{ V}$

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

11. Test information

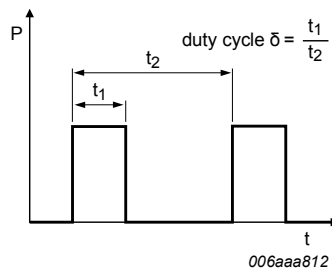


Fig. 17. Duty cycle definition

12. Package outline

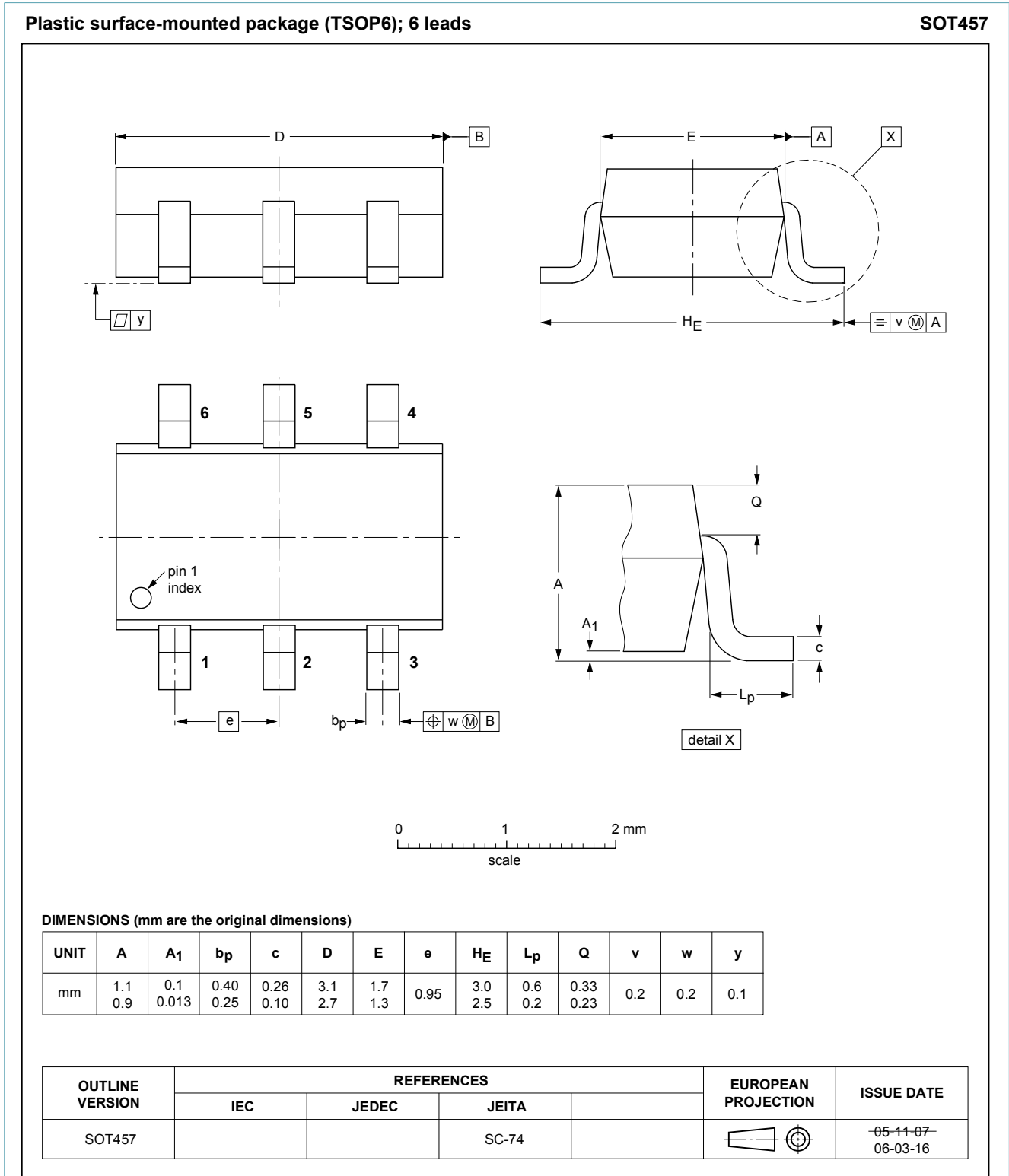


Fig. 18. Package outline TSOP6 (SOT457)

13. Soldering

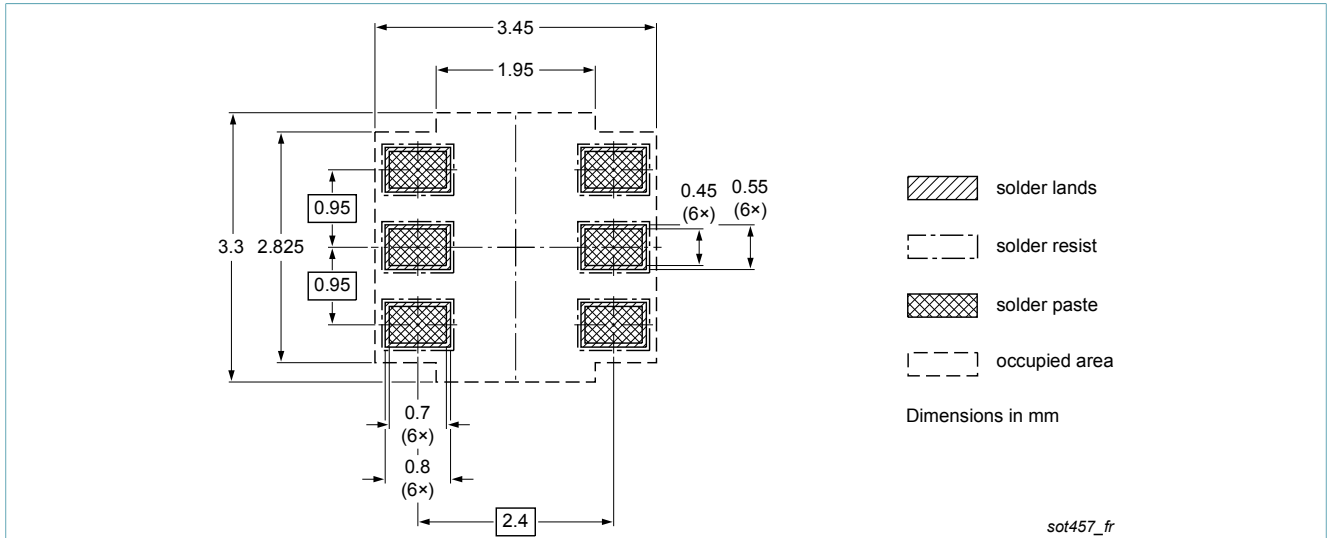


Fig. 19. Reflow soldering footprint for TSOP6 (SOT457)

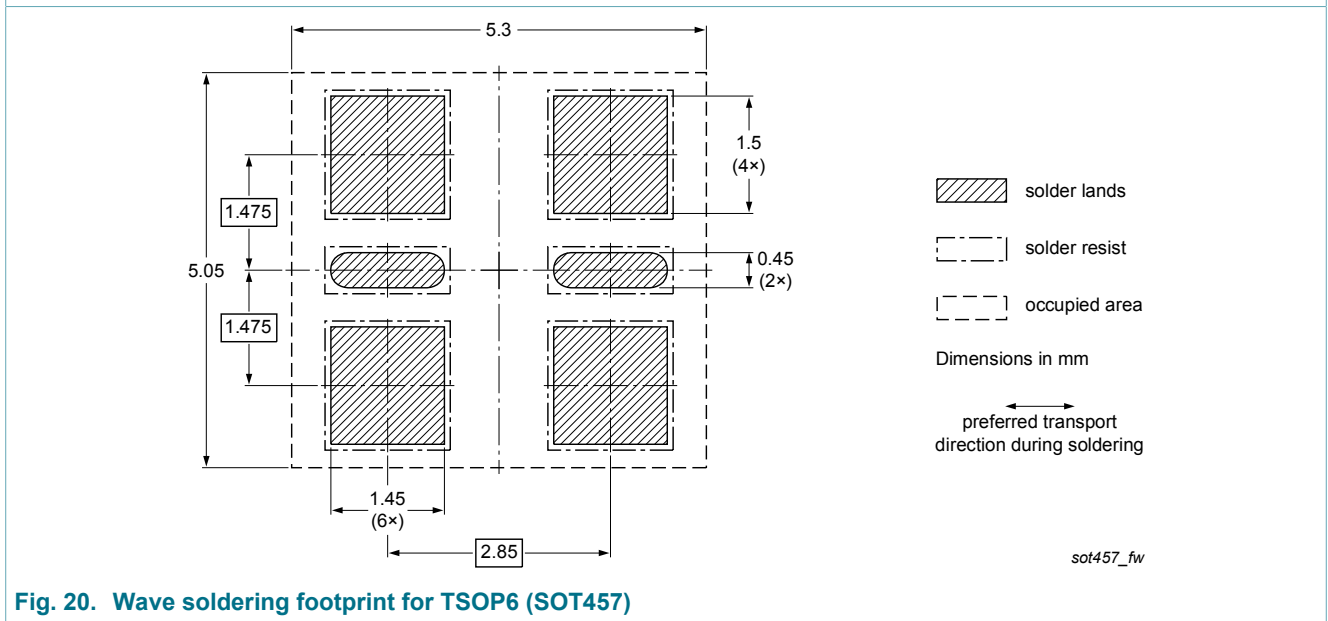


Fig. 20. Wave soldering footprint for TSOP6 (SOT457)

14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| PMN70EPE v.1 | 20170523 | Product 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. |
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