



PSMN1R1-80CSF

NextPower 80 V, 1.16 mOhm, N-channel MOSFET in CCPAK1212i package

13 May 2024

Objective data sheet

1. General description

NextPower 80 V, standard level gate drive MOSFET. Qualified to 175 °C and recommended for high power industrial and consumer applications.

2. Features and benefits

- Low Q_{rr} for higher efficiency and lower spiking
- 400 Amps $I_{D(max)}$ continuous current rating
- Low $Q_G \times R_{DS(on)}$ FOM for high efficiency switching applications
- Strong avalanche energy rating (E_{as})
- Avalanche rated and 100% tested
- Ha-free and RoHS compliant CCPAK1212i package
- Inverted package, suitable for top-side cooling

3. Applications

- Battery protection
- High power full and half-bridge configurations
- BLDC motor control
- OR-ing

4. Quick reference data

Table 1. Quick reference data

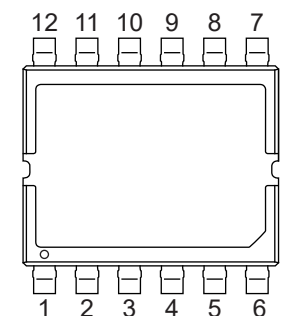
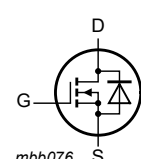
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--|--|-------|-------|-------|------|
| V_{DS} | drain-source voltage | $25\text{ °C} \leq T_j \leq 175\text{ °C}$ | - | - | 80 | V |
| I_D | drain current | $V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C}$ | [1] | - | 400 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}; \text{Fig. 1}$ | - | - | 1.071 | kW |
| T_j | junction temperature | | -55 | - | 175 | °C |
| Static characteristics | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ °C}$ | - | 0.92 | 1.16 | mΩ |
| | | $V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 100\text{ °C}$ | - | [tbd] | [tbd] | mΩ |
| Dynamic characteristics | | | | | | |
| Q_{GD} | gate-drain charge | $I_D = 25\text{ A}; V_{DS} = 40\text{ V}; V_{GS} = 10\text{ V}; T_j = 25\text{ °C}; \text{Fig. 2}$ | - | 34 | - | nC |
| $Q_{G(tot)}$ | total gate charge | | [tbd] | 206 | [tbd] | nC |
| Avalanche ruggedness | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 109\text{ A}; V_{sup} \leq 80\text{ V}; R_{GS} = 50\text{ Ω}; V_{GS} = 10\text{ V}; T_{j(init)} = 25\text{ °C}; \text{unclamped}$ | [2] | - | 1325 | mJ |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------------|------------------|--|-----|-----|-----|------|
| Source-drain diode | | | | | | |
| Q_r | recovered charge | $I_S = 25\text{ A}$; $di_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$; $V_{DS} = 40\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 3 | [3] | - | 82 | - nC |

- [1] Max current will be demonstrated through application tests. Practically the current will be limited by PCB, thermal design and operating temperature.
- [2] Protected by 100% test
- [3] includes capacitive recovery

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-----------------------------------|---|---|
| 1 | S | source |  <p style="text-align: center;"><i>sot8005a_sv</i> CCPAK1212i (SOT8005A)</p> |  <p style="text-align: center;"><i>mbb076</i></p> |
| 2 | S | source | | |
| 3 | S | source | | |
| 4 | S | source | | |
| 5 | S | source | | |
| 6 | G | gate | | |
| 7 | D | drain | | |
| 8 | D | drain | | |
| 9 | D | drain | | |
| 10 | D | drain | | |
| 11 | D | drain | | |
| 12 | D | drain | | |
| mb | D | mounting base; connected to drain | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | Version |
|---------------|------------|--|----------|
| | Name | Description | |
| PSMN1R1-80CSF | CCPAK1212i | Plastic, surface mounted copper clip package (CCPAK1212i); 12 terminals; 2.0 mm pitch, 12 mm × 12 mm × 2.5 mm body | SOT8005A |

7. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). $T_j = 25\text{ °C}$ unless otherwise stated.

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|-----------------------------|--|--|-----|-----|-------|------|
| V_{DS} | drain-source voltage | $25\text{ °C} \leq T_j \leq 175\text{ °C}$ | | - | 80 | V |
| V_{GS} | gate-source voltage | | | -20 | 20 | V |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C}$; Fig. 1 | | - | 1.071 | kW |
| I_D | drain current | $V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$ | [1] | - | 400 | A |
| | | $V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ °C}$ | | - | 282 | A |
| I_{DM} | peak drain current | pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$ | | - | 1600 | A |
| T_{stg} | storage temperature | | | -55 | 175 | °C |
| T_j | junction temperature | | | -55 | 175 | °C |
| Source-drain diode | | | | | | |
| I_S | source current | $T_{mb} = 25\text{ °C}$ | | - | 400 | A |
| I_{SM} | peak source current | pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$ | | - | 1600 | A |
| Avalanche ruggedness | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $I_D = 109\text{ A}$; $V_{sup} \leq 80\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; unclamped | [2] | - | 1325 | mJ |

- [1] Max current will be demonstrated through application tests. Practically the current will be limited by PCB, thermal design and operating temperature.
- [2] Protected by 100% test

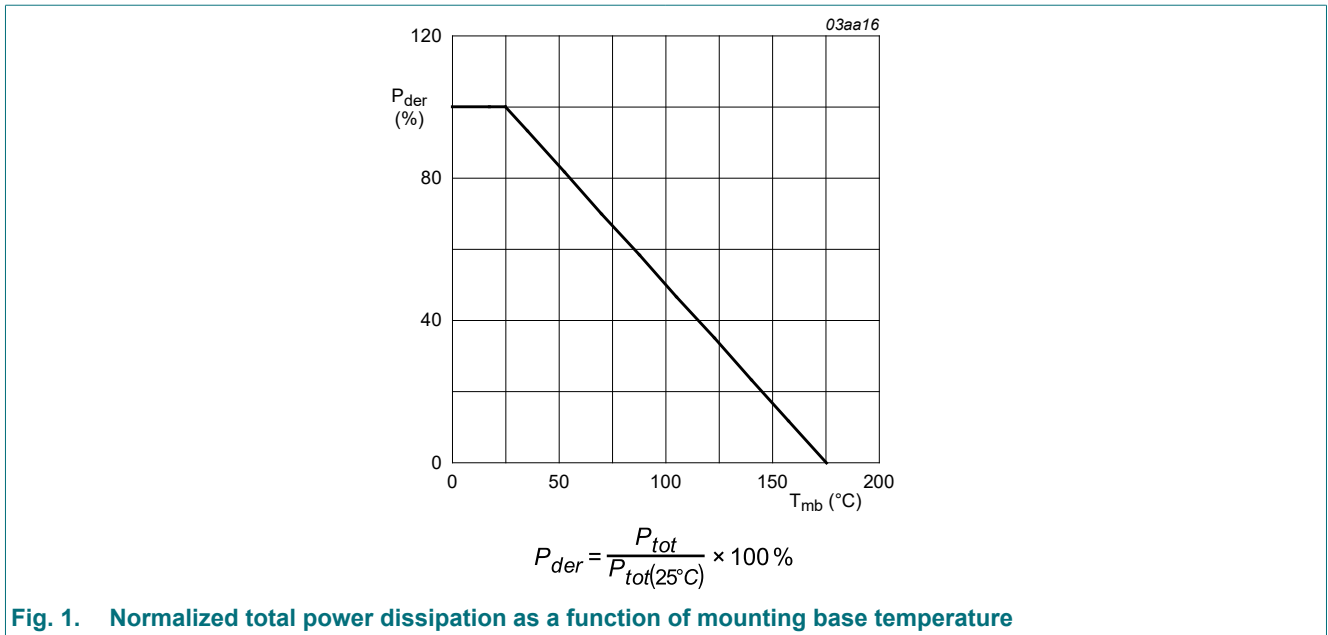


Fig. 1. Normalized total power dissipation as a function of mounting base temperature

8. Thermal characteristics

Table 5. Thermal characteristics

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|----------------|---|------------|--|-----|-------|------|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | | | - | [tbd] | 0.14 | K/W |

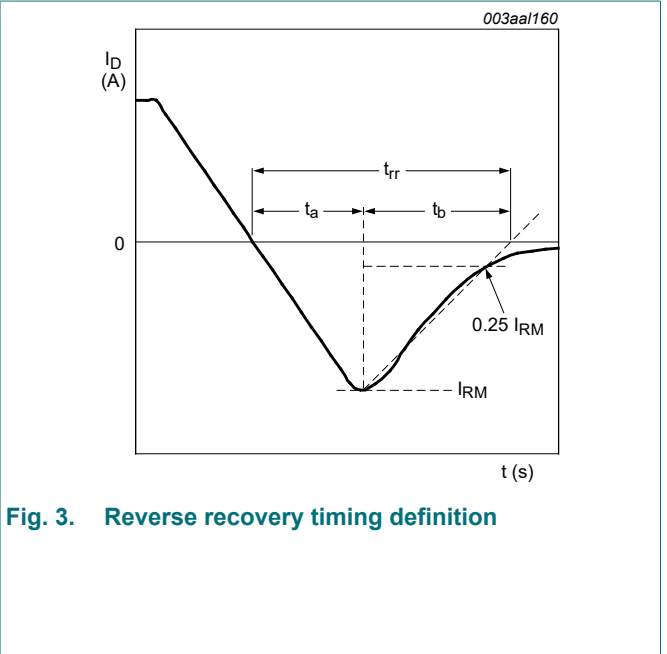
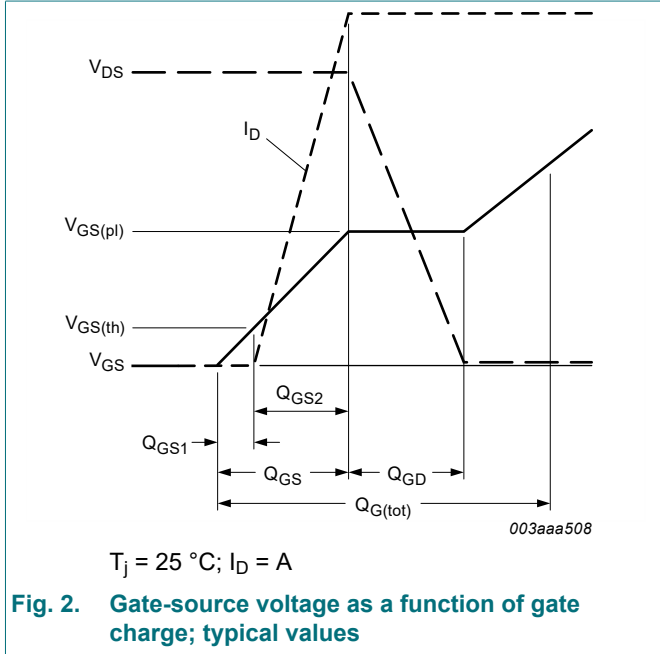
9. Characteristics

Table 6. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--|--|-------|-------|-------|------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$ | 80 | - | - | V |
| | | $I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$ | 72 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = 25 \text{ }^\circ C$ | 2 | 3 | 4 | V |
| | | $I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = 175 \text{ }^\circ C$ | - | 1.6 | - | V |
| | | $I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = -55 \text{ }^\circ C$ | - | 3.5 | - | V |
| $\Delta V_{GS(th)}/\Delta T$ | gate-source threshold voltage variation with temperature | $25 \text{ }^\circ C \leq T_j \leq 150 \text{ }^\circ C$ | - | [tbd] | - | mV/K |
| I_{DSS} | drain leakage current | $V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$ | - | [tbd] | 5 | μA |
| | | $V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ C$ | - | [tbd] | [tbd] | μA |
| I_{GSS} | gate leakage current | $V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$ | - | 2 | 100 | nA |
| | | | - | 2 | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ C$ | - | 0.92 | 1.16 | m Ω |
| | | $V_{GS} = 7 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ C$ | - | 1.04 | 1.3 | m Ω |
| | | $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 100 \text{ }^\circ C$ | - | [tbd] | [tbd] | m Ω |
| | | $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ C$ | - | [tbd] | [tbd] | m Ω |
| R_G | gate resistance | $f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ C$ | [tbd] | [tbd] | [tbd] | Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 25 \text{ A}; V_{DS} = 40 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ C; \text{ Fig. 2}$ | [tbd] | 206 | [tbd] | nC |
| | | $I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ C$ | - | 107 | - | nC |
| Q_{GS} | gate-source charge | $I_D = 25 \text{ A}; V_{DS} = 40 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ C; \text{ Fig. 2}$ | [tbd] | 61 | [tbd] | nC |
| $Q_{GS(th)}$ | pre-threshold gate-source charge | $I_D = 25 \text{ A}; V_{DS} = 40 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ C$ | - | 42 | - | nC |
| $Q_{GS(th-pl)}$ | post-threshold gate-source charge | | - | 19 | - | nC |
| Q_{GD} | gate-drain charge | $I_D = 25 \text{ A}; V_{DS} = 40 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ C; \text{ Fig. 2}$ | - | 34 | - | nC |
| $V_{GS(pl)}$ | gate-source plateau voltage | $I_D = 25 \text{ A}; V_{DS} = 40 \text{ V}; T_j = 25 \text{ }^\circ C$ | - | [tbd] | - | V |
| C_{iss} | input capacitance | $V_{DS} = 40 \text{ V}; V_{GS} = 0 \text{ V}; f = 0.5 \text{ MHz}; T_j = 25 \text{ }^\circ C$ | [tbd] | 15363 | [tbd] | pF |
| C_{oss} | output capacitance | | [tbd] | 4580 | [tbd] | pF |
| C_{rss} | reverse transfer capacitance | | [tbd] | 104 | [tbd] | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 40 \text{ V}; R_L = 1.6 \text{ } \Omega; V_{GS} = 10 \text{ V}; R_{G(ext)} = 5 \text{ } \Omega; T_j = 25 \text{ }^\circ C$ | - | 55 | - | ns |
| t_r | rise time | | - | 46 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 127 | - | ns |
| t_f | fall time | | - | 64 | - | ns |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 25 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$ | - | [tbd] | 1 | V |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------|-----------------------|--|-----|-----|-----|------|
| t_{rr} | reverse recovery time | $I_S = 25 \text{ A}$; $di_S/dt = -100 \text{ A}/\mu\text{s}$; $V_{GS} = 0 \text{ V}$; | - | 71 | - | ns |
| Q_r | recovered charge | $V_{DS} = 40 \text{ V}$; $T_j = 25 \text{ }^\circ\text{C}$; Fig. 3 | [1] | 82 | - | nC |

[1] includes capacitive recovery



10. Package outline

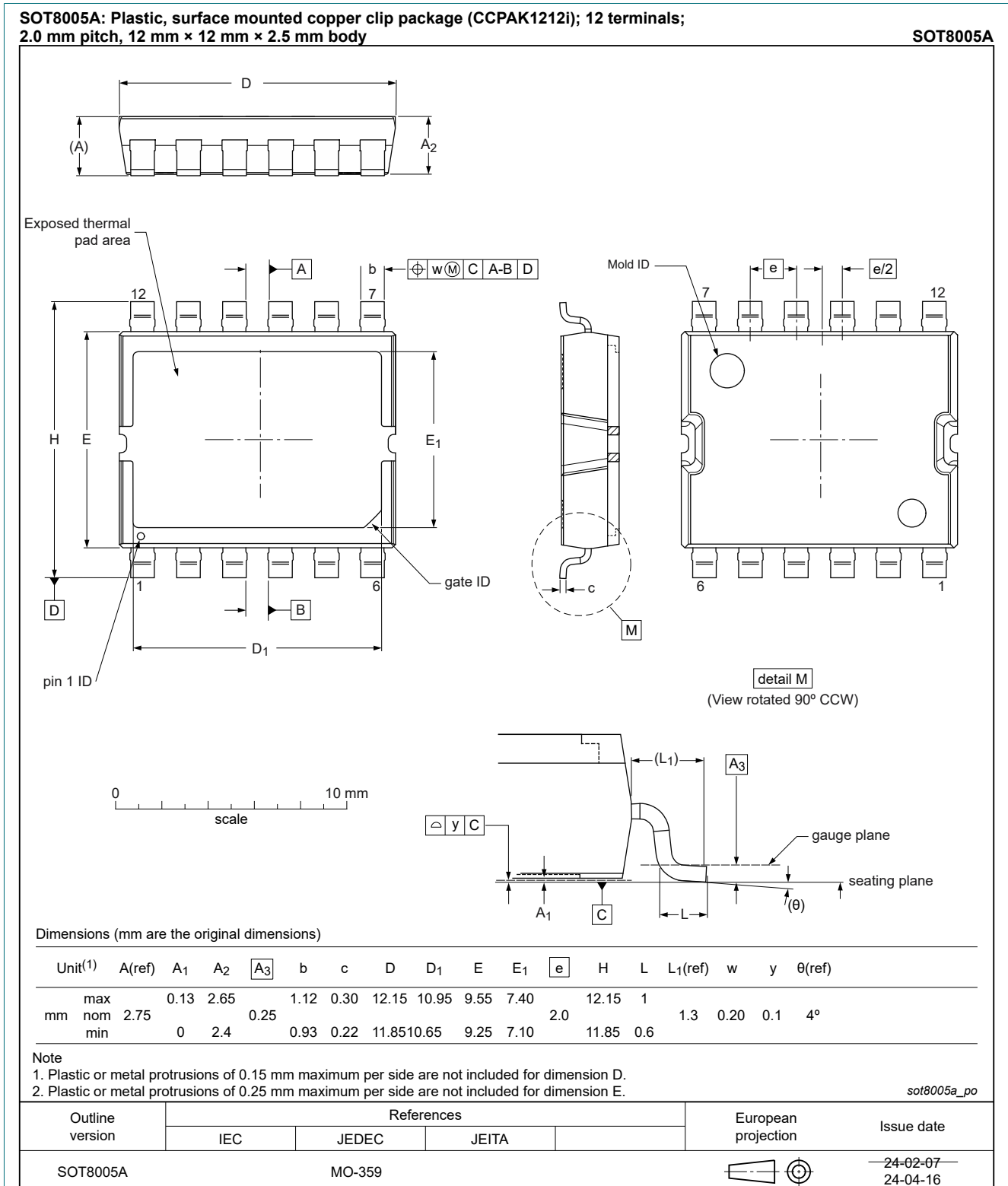


Fig. 4. Package outline CCPAK1212i (SOT8005A)

11. Legal information

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| Document status [1][2] | Product status [3] | Definition |
|--------------------------------|--------------------|---|
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| 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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