



# PSMNR90-80CSF

NextPower 80 V, 0.9 mOhm, N-channel MOSFET in  
CCPAK1212i package

6 December 2024

Product 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
- 505 Amps  $I_{D(max)}$  continuous current rating
- Low  $Q_G \times R_{DSon}$  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

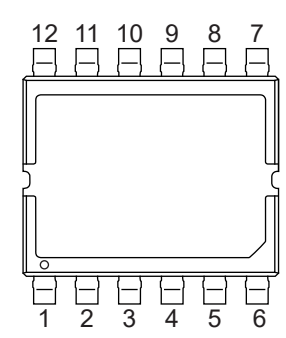
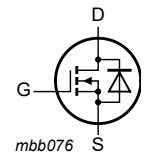
## 4. Quick reference data

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	$V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C};$ <a href="#">Fig. 2</a>	-	-	505	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C};$ <a href="#">Fig. 1</a>	-	-	1.55	kW
<b>Static characteristics</b>						
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ °C};$ <a href="#">Fig. 11</a>	-	0.72	0.9	mΩ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$I_D = 25\text{ A}; V_{DS} = 40\text{ V}; V_{GS} = 10\text{ V};$ $T_j = 25\text{ °C};$ <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>	12	42	96	nC

## 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> <b>CCPAK1212i (SOT8005A)</b></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		
	Name	Description	Version
PSMNR90-80CSF	CCPAK1212i	Plastic, surface mounted copper clip package (CCPAK1212i); 12 terminals; 2.0 mm pitch, 12 mm × 12 mm × 2.5 mm body	SOT8005A

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PSMNR90-80CSF	XPF90S80C

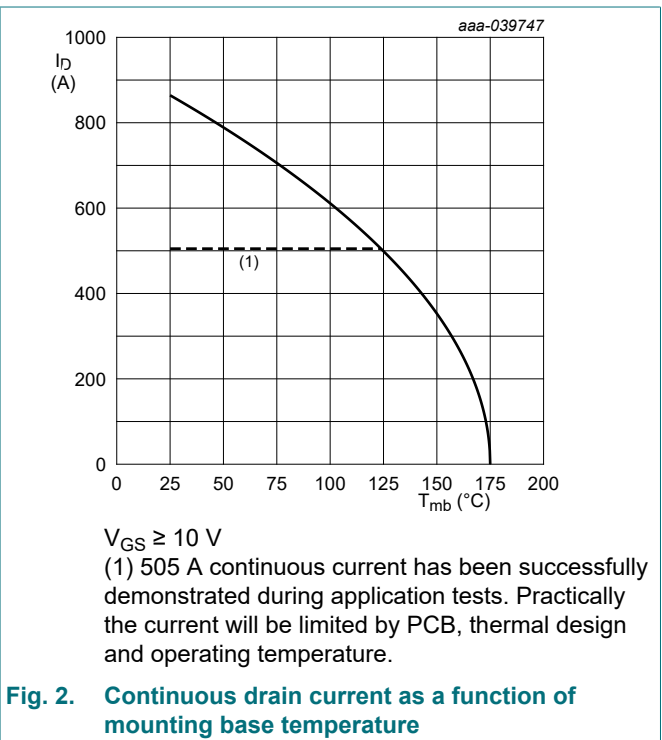
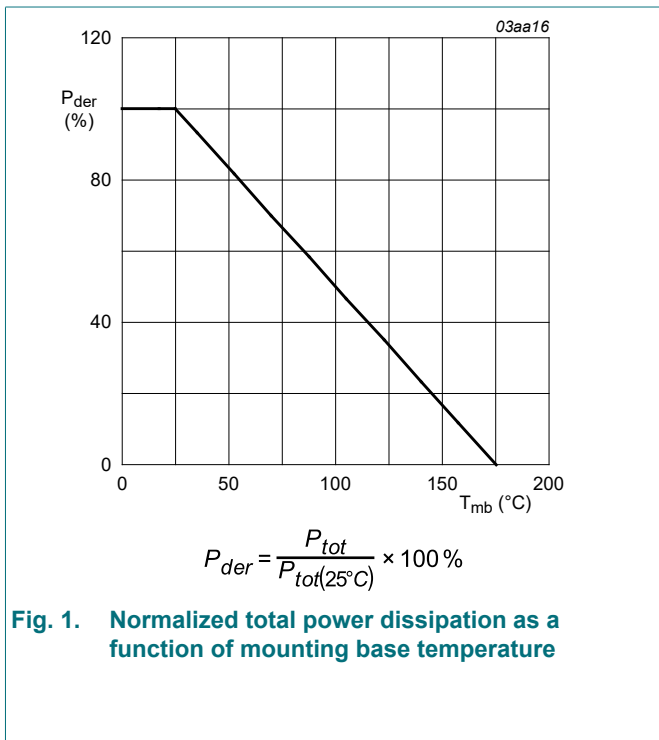
## 8. Limiting values

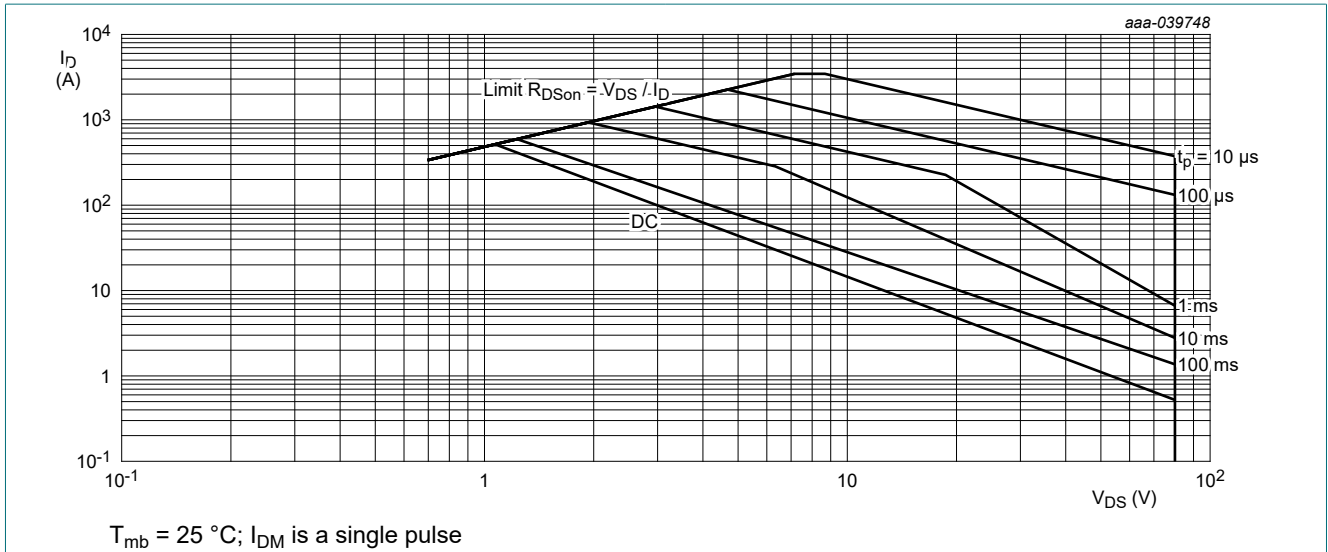
**Table 5. Limiting values**

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

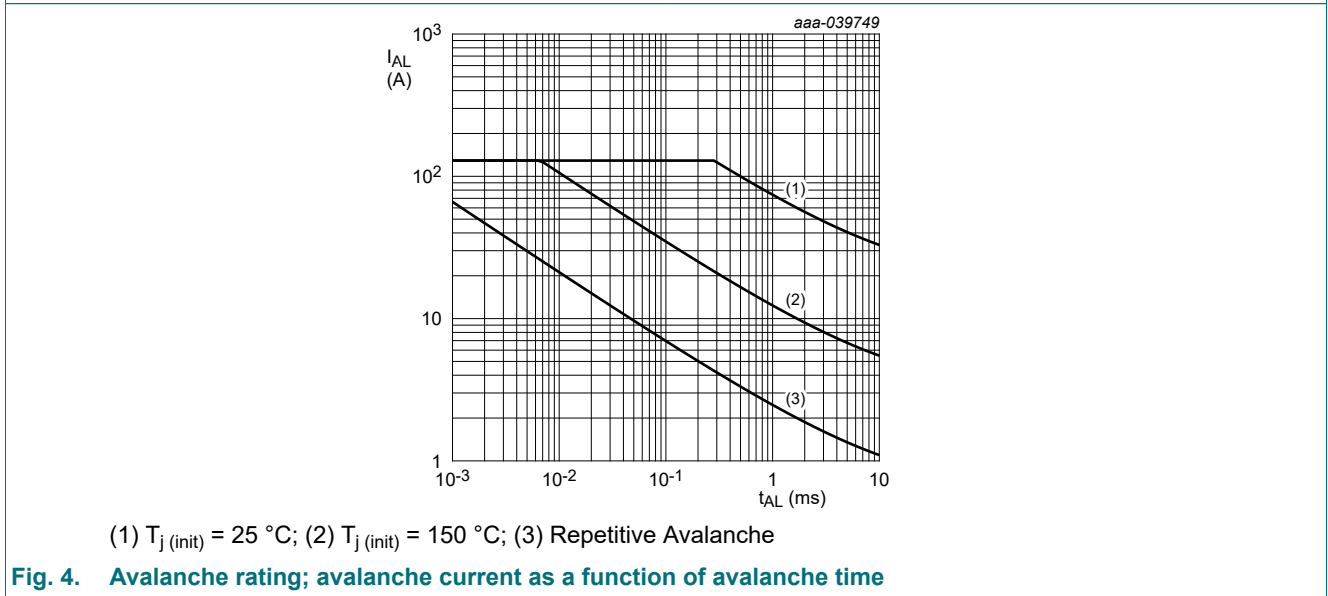
Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$	-	80	V
$V_{DGR}$	drain-gate voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$ ; $R_{GS} = 20\text{ k}\Omega$	-	80	V
$V_{GS}$	gate-source voltage		-20	20	V
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 1</a>	-	1.55	kW
$I_D$	drain current	$V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 2</a>	-	505	A
		$V_{GS} = 10\text{ V}$ ; $T_{mb} = 100\text{ °C}$ ; <a href="#">Fig. 2</a>	-	505	A
$I_{DM}$	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 3</a>	-	3457	A
$T_{stg}$	storage temperature		-55	175	°C
$T_j$	junction temperature		-55	175	°C
$T_{slid(M)}$	peak soldering temperature		-	260	°C
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25\text{ °C}$	-	435	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$	-	3457	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$I_D = 129\text{ A}$ ; $V_{sup} \leq 80\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(\text{init})} = 25\text{ °C}$ ; unclamped; $t_p = 282\text{ }\mu\text{s}$ ; <a href="#">Fig. 4</a>	[1]	-	1890 mJ
$I_{AS}$	non-repetitive avalanche current	$V_{sup} \leq 80\text{ V}$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(\text{init})} = 25\text{ °C}$ ; $R_{GS} = 50\text{ }\Omega$ ; <a href="#">Fig. 4</a>	[1]	-	129 A

[1] Protected by 100% test





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



**Fig. 4. Avalanche rating; avalanche current as a function of avalanche time**

## 9. Thermal characteristics

**Table 6. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	<a href="#">Fig. 5</a>	-	0.075	0.1	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	<a href="#">Fig. 6</a>	-	58	-	K/W
		<a href="#">Fig. 7</a>	-	29	-	K/W

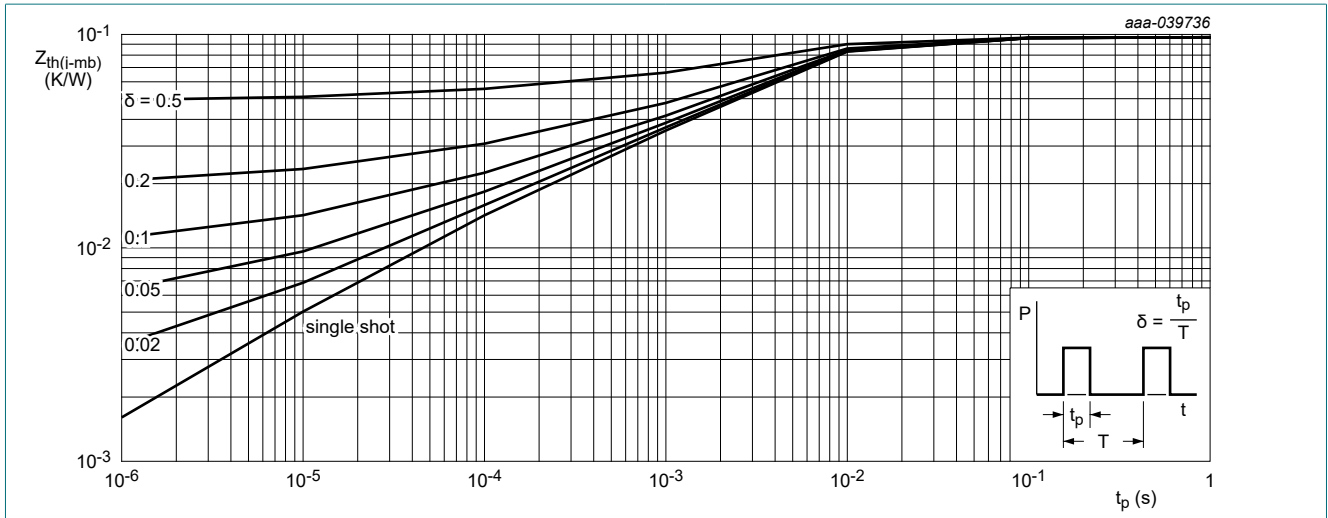
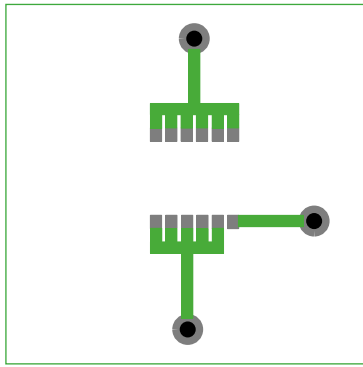
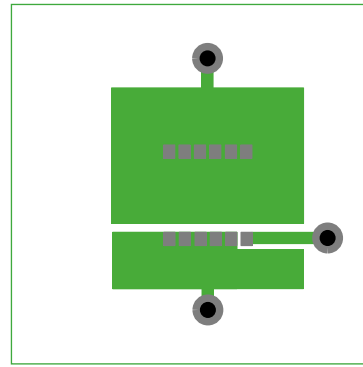


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration



70 μm thick copper on FR4 board

Fig. 6. PCB layout with minimum footprint for thermal resistance from junction to ambient



Copper area 25.4 mm square; 70 μm thick on FR4 board

Fig. 7. PCB layout for thermal resistance from junction to ambient

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	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
		$I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = 175 \text{ }^\circ C$	-	1.52	-	V
		$I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = -55 \text{ }^\circ C$	-	3.6	-	V
$\Delta V_{GS(th)}/\Delta T$	gate-source threshold voltage variation with temperature	$25 \text{ }^\circ C \leq T_j \leq 150 \text{ }^\circ C$	-	-9.73	-	mV/K
$I_{DSS}$	drain leakage current	$V_{DS} = 80 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	0.2	2	$\mu A$
		$V_{DS} = 80 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ C$	-	64	200	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	2	100	nA
		$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ C$ ; <a href="#">Fig. 11</a>	-	0.72	0.9	m $\Omega$
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 100 \text{ }^\circ C$ ; <a href="#">Fig. 12</a>	-	1.1	1.4	m $\Omega$
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ C$ ; <a href="#">Fig. 12</a>	-	1.6	2.1	m $\Omega$
		$V_{GS} = 7 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ C$ ; <a href="#">Fig. 11</a>	-	0.88	1.32	m $\Omega$
$R_G$	gate resistance	$f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ C$	0.66	1.31	2.62	$\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 25 \text{ A}; V_{DS} = 40 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ C$ ; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>	154	309	463	nC
		$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ C$	-	284	-	nC
$Q_{GS}$	gate-source charge	$I_D = 25 \text{ A}; V_{DS} = 40 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ C$ ; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>	58	97.3	136	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	66.1	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	31.2	-	nC
$Q_{GD}$	gate-drain charge		12	42	96	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 25 \text{ A}; V_{DS} = 40 \text{ V}; T_j = 25 \text{ }^\circ C$ ; <a href="#">Fig. 13</a> ; <a href="#">Fig. 14</a>	-	4.3	-	V
$C_{iss}$	input capacitance	$V_{DS} = 40 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ C$ ; <a href="#">Fig. 15</a>	13764	22939	32115	pF
$C_{oss}$	output capacitance		3685	6142	9827	pF
$C_{rss}$	reverse transfer capacitance		9	93	278	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 40 \text{ V}; R_L = 1.6 \text{ } \Omega; V_{GS} = 10 \text{ V}; R_{G(ext)} = 5 \text{ } \Omega; T_j = 25 \text{ }^\circ C$	-	91	-	ns
$t_r$	rise time		-	69	-	ns
$t_{d(off)}$	turn-off delay time		-	203	-	ns
$t_f$	fall time		-	91	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 25 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$ ; <a href="#">Fig. 16</a>	-	0.74	1	V

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{rr}$	reverse recovery time	$I_S = 25 \text{ A}$ ; $di_S/dt = -100 \text{ A}/\mu\text{s}$ ; $V_{GS} = 0 \text{ V}$ ;	-	77	-	ns
$Q_r$	recovered charge	$V_{DS} = 40 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; Fig. 17	-	94	-	nC

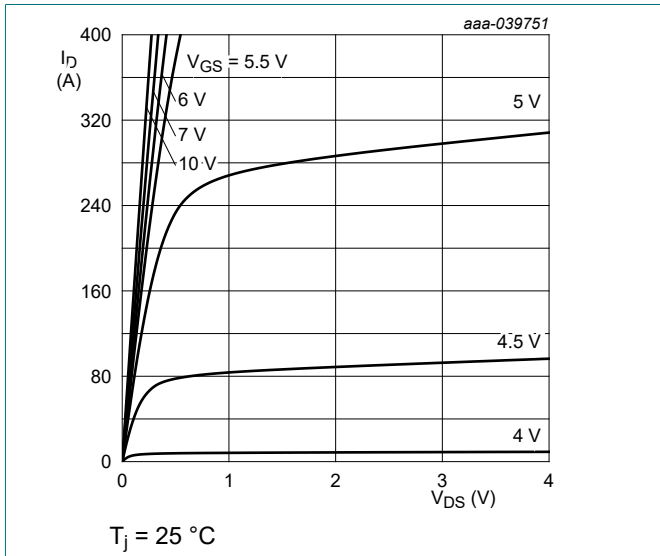


Fig. 8. Output characteristics; drain current as a function of drain-source voltage; typical values

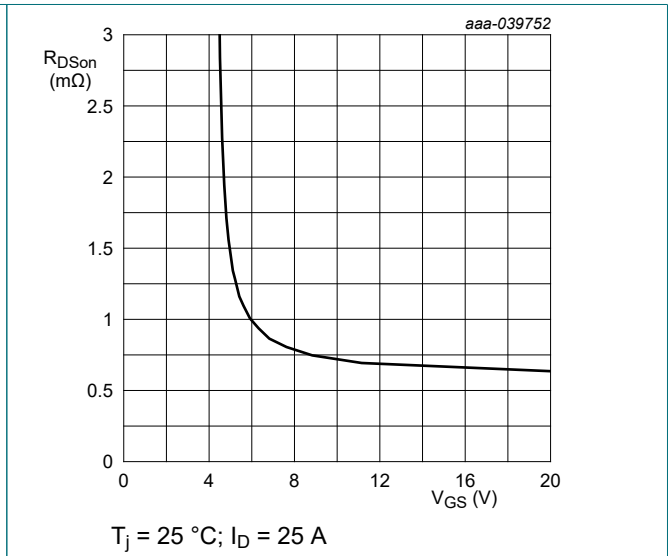


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

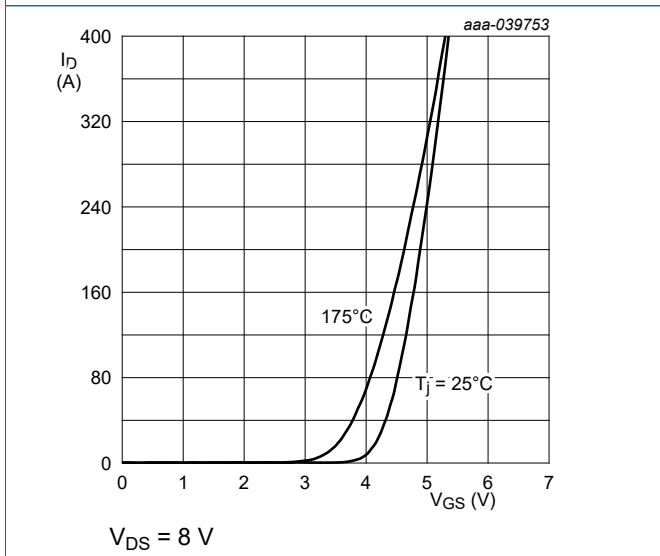


Fig. 10. Transfer characteristics; drain current as a function of gate-source voltage; typical values

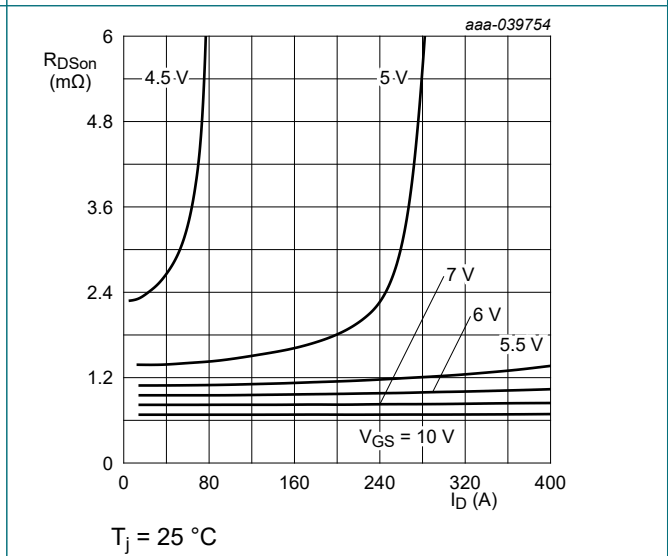
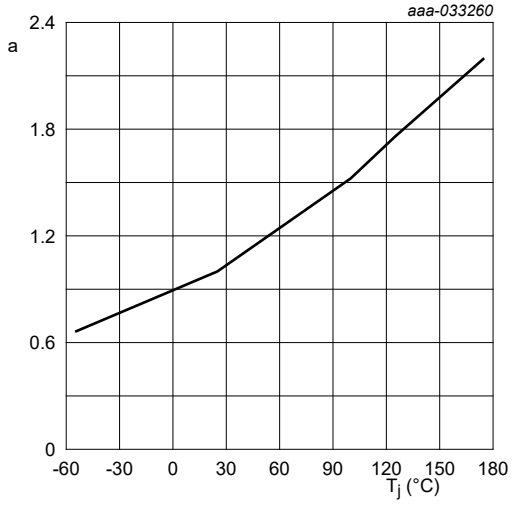


Fig. 11. Drain-source on-state resistance as a function of drain current; typical values



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

Fig. 12. Normalized drain-source on-state resistance factor as a function of junction temperature

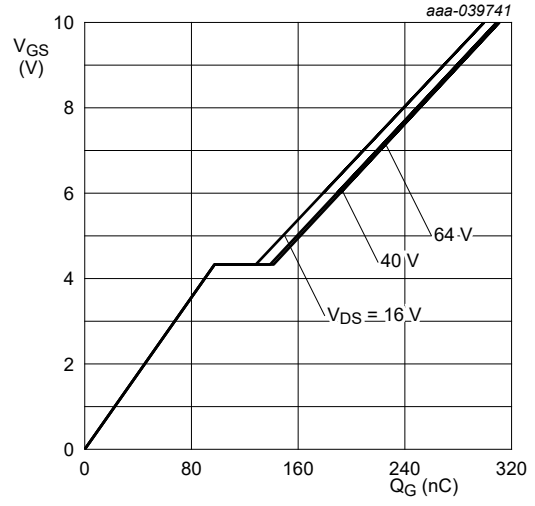


Fig. 13. Gate-source voltage as a function of gate charge; typical values

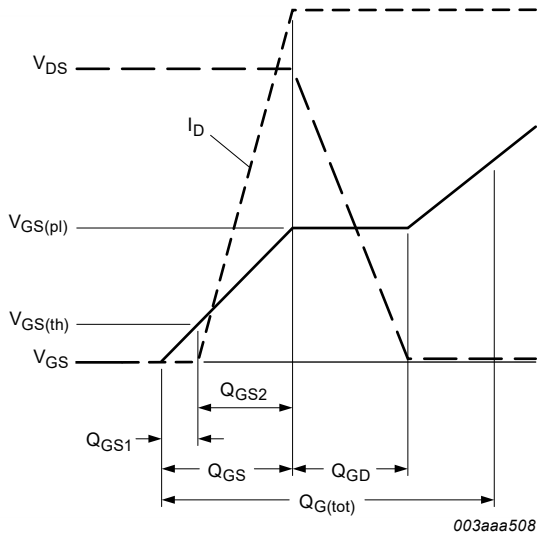


Fig. 14. Gate charge waveform definitions

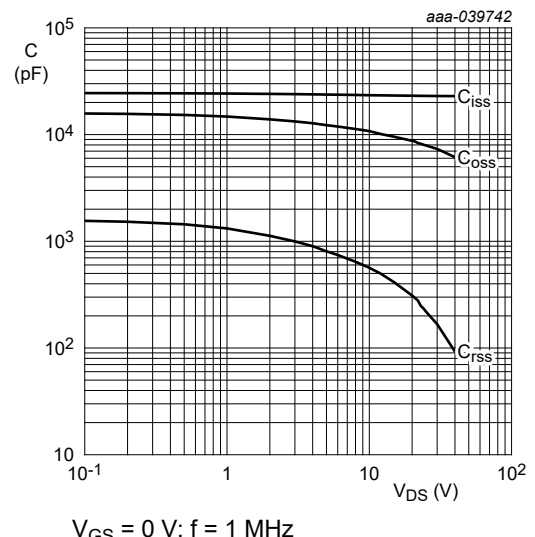
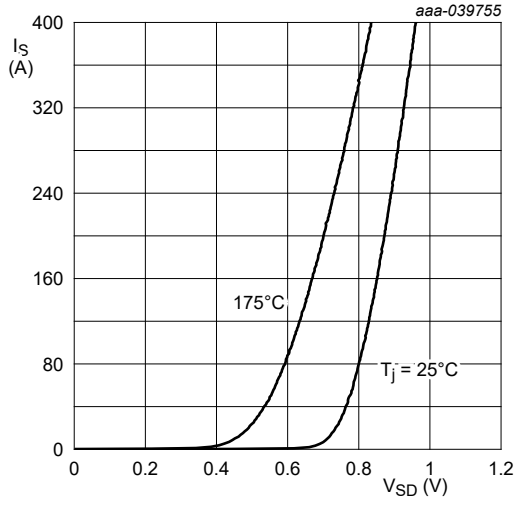


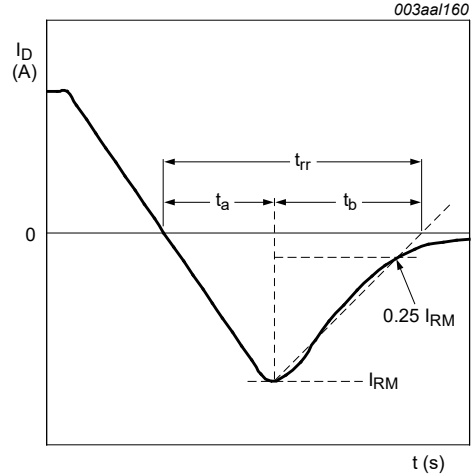
Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values





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

**Fig. 16. Source-drain (diode forward) current as a function of source-drain (diode forward) voltage; typical values**



**Fig. 17. Reverse recovery timing definition**

### 11. Package outline

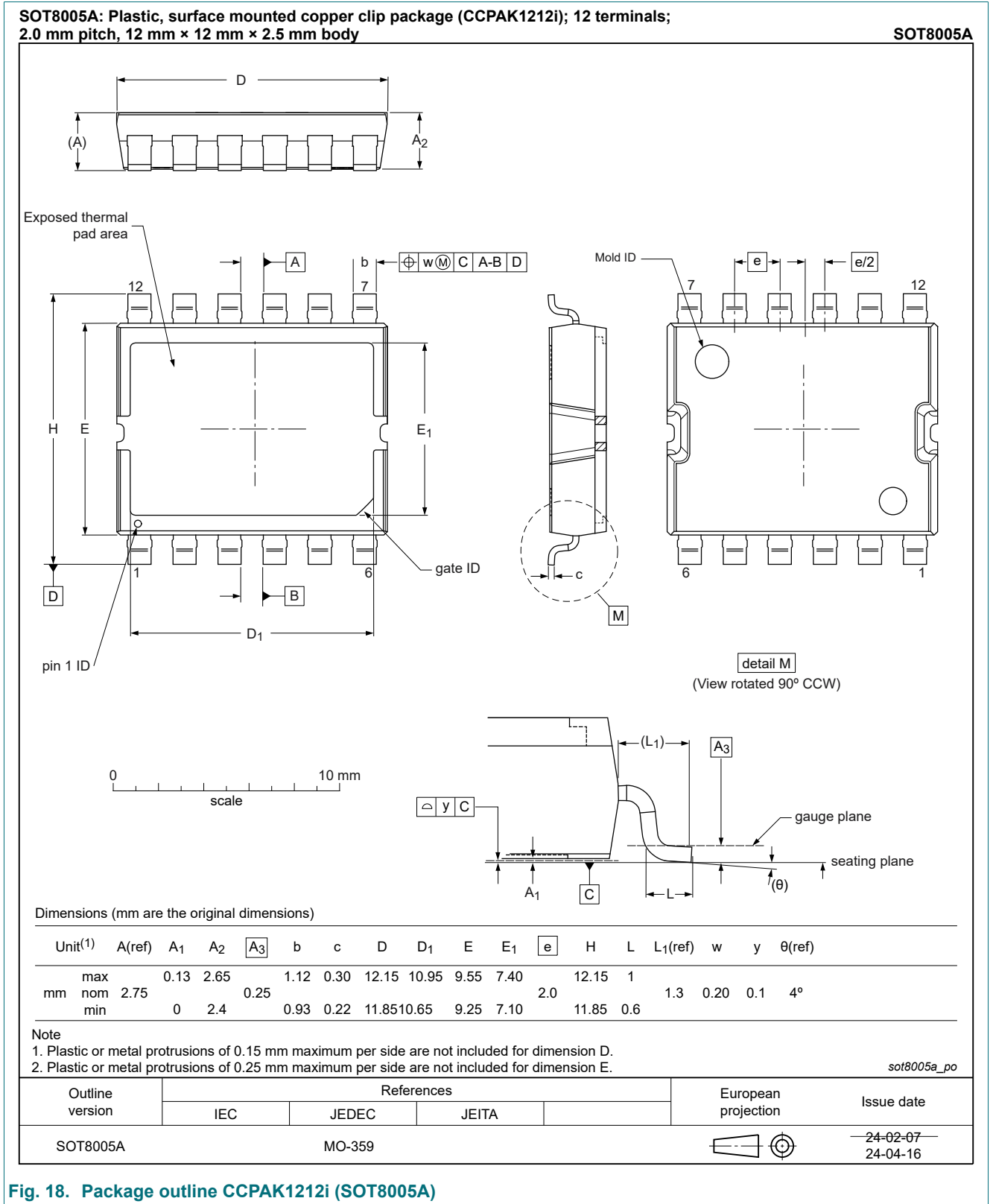


Fig. 18. Package outline CCPAK1212i (SOT8005A)

## 12. Soldering

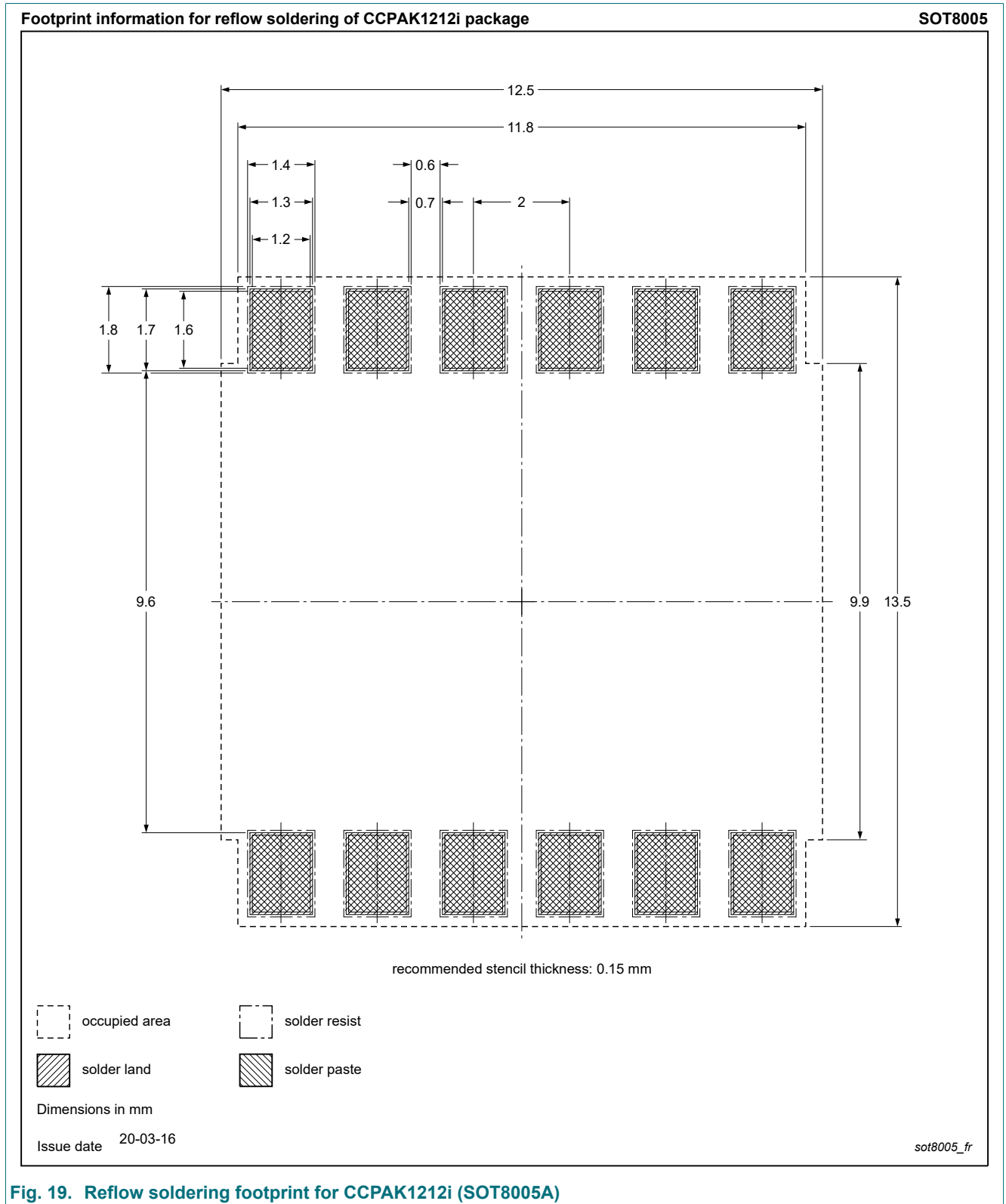


Fig. 19. Reflow soldering footprint for CCPAK1212i (SOT8005A)

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