

# **NXP PSMNR90-30BL MOSFET datasheet**

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Logic level N-channel MOSFET in D2PAK package qualified to 175 °C. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

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# PSMNR90-30BL

N-channel 30 V 1.0 mΩ logic level MOSFET in D2PAK

2 April 2014

Product data sheet

## 1. General description

Logic level N-channel MOSFET in D2PAK package qualified to 175 °C. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

## 2. Features and benefits

- High efficiency due to low switching and conduction losses
- Suitable for logic level gate drive sources

## 3. Applications

- DC-to-DC converters
- Load switching
- Motor control
- Server power supplies

## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	30	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ <a href="#">Fig. 2</a>	[1]	-	120	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C};$ <a href="#">Fig. 1</a>	-	-	306	W
$T_j$	junction temperature		-55	-	175	°C
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ °C};$ <a href="#">Fig. 12</a>	-	0.89	1	mΩ
		$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 100\text{ °C};$ <a href="#">Fig. 13; Fig. 12</a>	-	1.19	1.5	mΩ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 4.5\text{ V}; I_D = 75\text{ A}; V_{DS} = 15\text{ V};$ <a href="#">Fig. 14; Fig. 15</a>	-	37	-	nC
$Q_{G(tot)}$	total gate charge		-	118	-	nC



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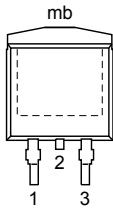
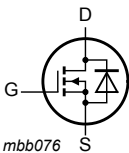


Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$ ; $T_{j(\text{init})} = 25\text{ °C}$ ; $I_D = 120\text{ A}$ ; $V_{sup} \leq 30\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ; unclamped	-	-	1.9	J

[1] Continuous current is limited by package.

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p><b>D2PAK (SOT404)</b></p>	
2	D	drain[1]		
3	S	source		
mb	D	mounting base; connected to drain		

[1] It is not possible to make connection to pin 2

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMNR90-30BL	D2PAK	plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)	SOT404

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PSMNR90-30BL	PSMNR90-30BL

## 8. Limiting values

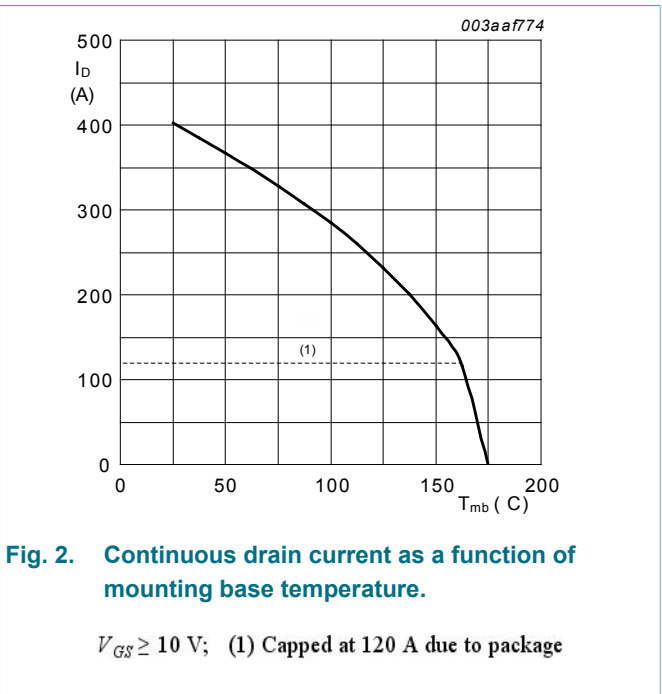
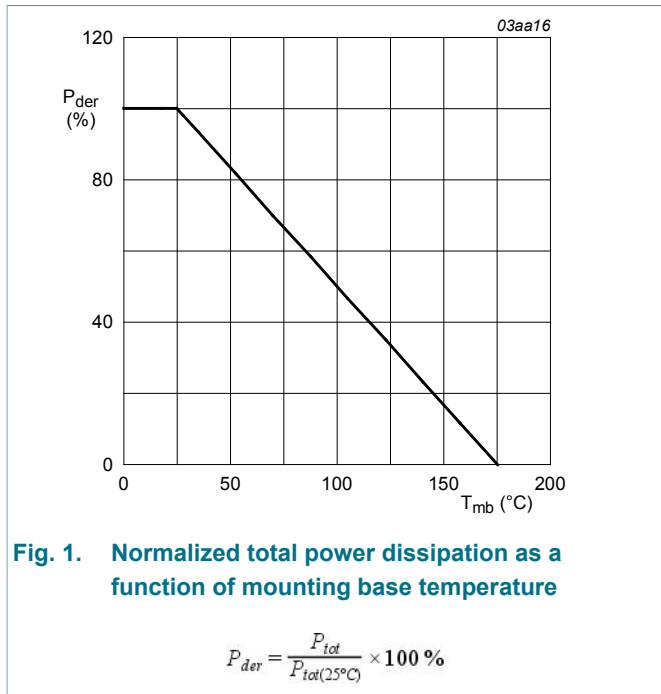
Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	30	V
$V_{DGR}$	drain-gate voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$ ; $R_{GS} = 20\text{ k}\Omega$	-	30	V

Symbol	Parameter	Conditions		Min	Max	Unit
V <sub>GS</sub>	gate-source voltage			-20	20	V
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; Fig. 1		-	306	W
I <sub>D</sub>	drain current	V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 100 °C; Fig. 2	[1]	-	120	A
		V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 25 °C; Fig. 2	[1]	-	120	A
I <sub>DM</sub>	peak drain current	pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C; Fig. 3		-	1573	A
T <sub>stg</sub>	storage temperature			-55	175	°C
T <sub>j</sub>	junction temperature			-55	175	°C
T <sub>slid(M)</sub>	peak soldering temperature			-	260	°C
<b>Source-drain diode</b>						
I <sub>S</sub>	source current	T <sub>mb</sub> = 25 °C	[1]	-	120	A
I <sub>SM</sub>	peak source current	pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C		-	1573	A
<b>Avalanche ruggedness</b>						
E <sub>DS(AL)S</sub>	non-repetitive drain-source avalanche energy	V <sub>GS</sub> = 10 V; T <sub>j(initial)</sub> = 25 °C; I <sub>D</sub> = 120 A; V <sub>sup</sub> ≤ 30 V; R <sub>GS</sub> = 50 Ω; unclamped		-	1.9	J

[1] Continuous current is limited by package.



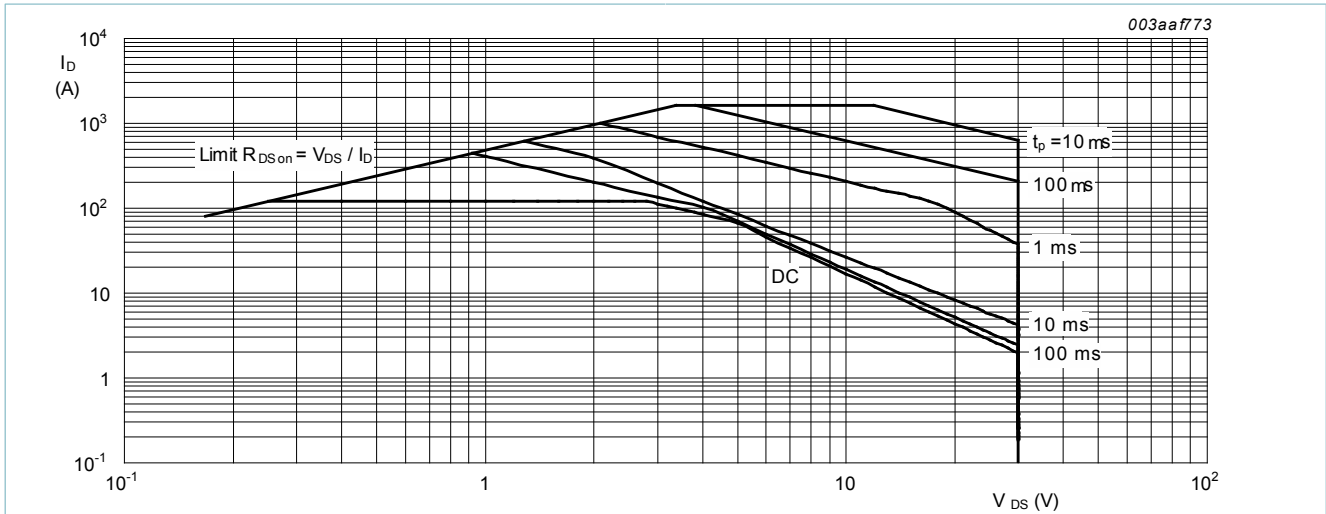


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25\text{ °C}$ ;  $I_{DM}$  is a single pulse; Capped at 120 A due to package

### 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	Fig. 4	-	0.22	0.49	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	minimum footprint; mounted on a printed-circuit board	-	50	-	K/W

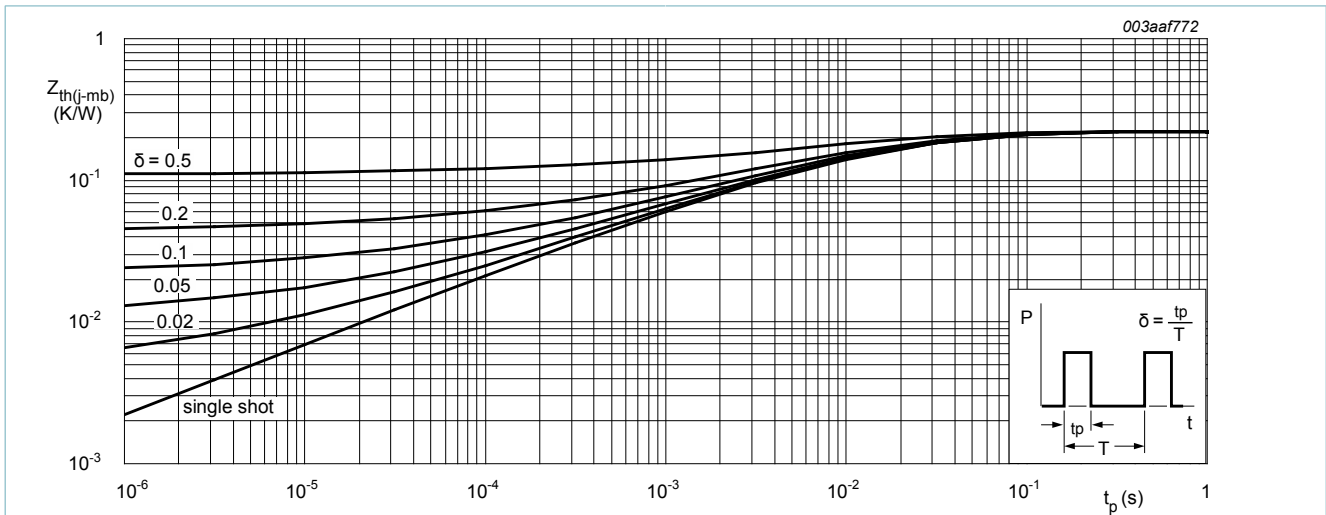


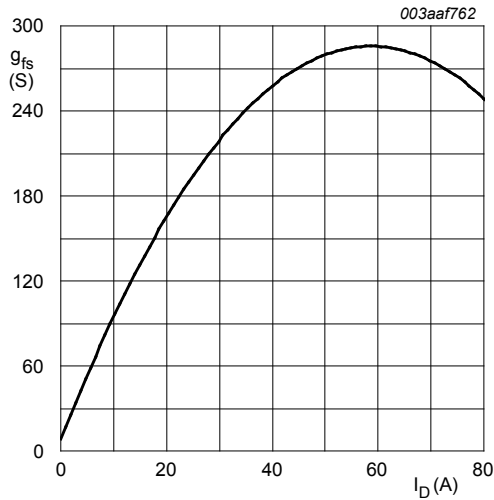
Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

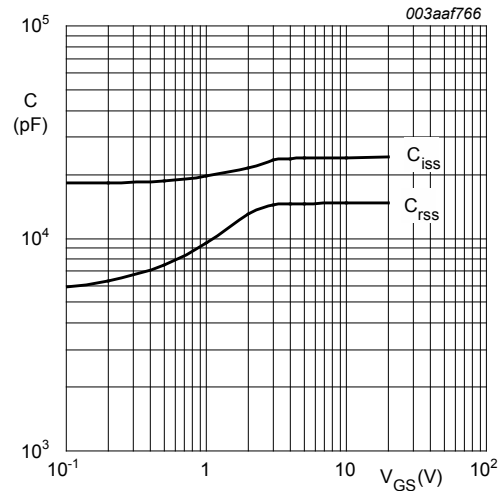
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	30	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	27	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C;$ <a href="#">Fig. 10</a> ; <a href="#">Fig. 11</a>	1.3	1.7	2.2	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ C;$ <a href="#">Fig. 11</a>	0.65	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C;$ <a href="#">Fig. 11</a>	-	-	2.5	V
$I_{DSS}$	drain leakage current	$V_{DS} = 30 V; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	-	0.02	10	$\mu A$
		$V_{DS} = 30 V; V_{GS} = 0 V; T_j = 175 \text{ }^\circ C$	-	-	500	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 16 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$	-	10	100	nA
		$V_{GS} = -16 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$	-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 V; I_D = 25 A; T_j = 25 \text{ }^\circ C;$ <a href="#">Fig. 12</a>	-	0.89	1	mΩ
		$V_{GS} = 4.5 V; I_D = 25 A; T_j = 25 \text{ }^\circ C;$ <a href="#">Fig. 12</a>	-	1.1	1.4	mΩ
		$V_{GS} = 10 V; I_D = 25 A; T_j = 175 \text{ }^\circ C;$ <a href="#">Fig. 13</a> ; <a href="#">Fig. 12</a>	-	1.65	2	mΩ
		$V_{GS} = 10 V; I_D = 25 A; T_j = 100 \text{ }^\circ C;$ <a href="#">Fig. 13</a> ; <a href="#">Fig. 12</a>	-	1.19	1.5	mΩ
$R_G$	gate resistance	$f = 1 \text{ MHz}$	-	1.1	-	Ω
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 75 A; V_{DS} = 15 V; V_{GS} = 10 V;$ <a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a>	-	243	-	nC
		$I_D = 0 A; V_{DS} = 0 V; V_{GS} = 10 V$	-	222	-	nC
		$I_D = 75 A; V_{DS} = 15 V; V_{GS} = 4.5 V;$ <a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a>	-	118	-	nC
$Q_{GS}$	gate-source charge		-	39	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	22	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	17	-	nC
$Q_{GD}$	gate-drain charge		-	37	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 75 A; V_{DS} = 15 V;$ <a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a>	-	2.8	-	V

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$C_{iss}$	input capacitance	$V_{DS} = 15\text{ V}; V_{GS} = 0\text{ V}; f = 1\text{ MHz};$ $T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 16</a>	-	14850	-	pF
$C_{oss}$	output capacitance		-	2799	-	pF
$C_{rss}$	reverse transfer capacitance		-	1215	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 15\text{ V}; R_L = 0.2\text{ }\Omega; V_{GS} = 5\text{ V};$ $R_{G(ext)} = 5\text{ }\Omega; I_D = 75\text{ A}; T_j = 25\text{ }^\circ\text{C}$	-	95	-	ns
$t_r$	rise time	$V_{DS} = 15\text{ V}; R_L = 0.2\text{ }\Omega; V_{GS} = 5\text{ V};$ $R_{G(ext)} = 5\text{ }\Omega; T_j = 25\text{ }^\circ\text{C}; I_D = 75\text{ A}$	-	213	-	ns
$t_{d(off)}$	turn-off delay time	$V_{DS} = 15\text{ V}; R_L = 0.2\text{ }\Omega; V_{GS} = 5\text{ V};$ $R_{G(ext)} = 5\text{ }\Omega; I_D = 75\text{ A}; T_j = 25\text{ }^\circ\text{C}$	-	199	-	ns
$t_f$	fall time		-	115	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 25\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C};$ <a href="#">Fig. 17</a>	-	0.8	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 25\text{ A}; di_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V};$	-	67	-	ns
$Q_r$	recovered charge	$V_{DS} = 15\text{ V}$	-	123	-	nC



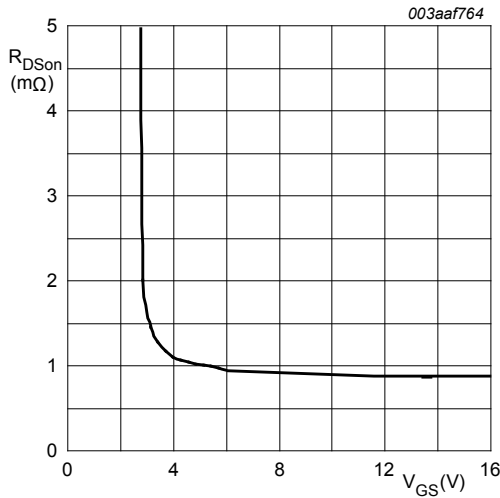
**Fig. 5. Forward transconductance as a function of drain current; typical values**

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



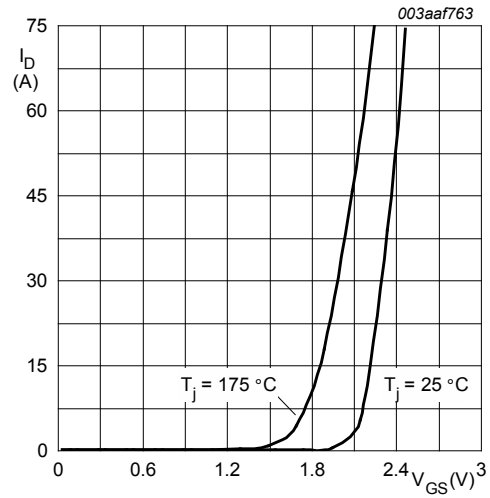
**Fig. 6. Input and reverse transfer capacitances as a function of gate-source voltage; typical values**

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



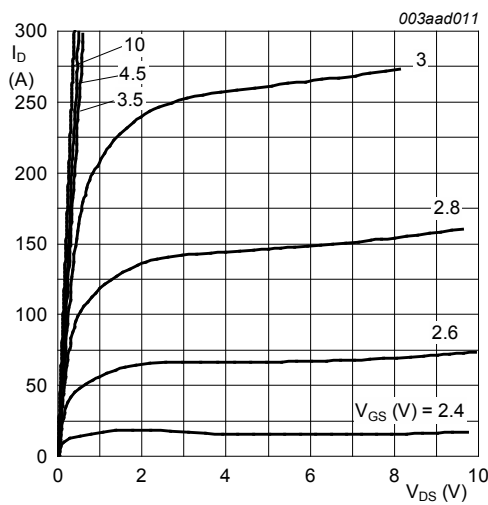
**Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values**

$T_j = 25\text{ }^\circ\text{C}; I_D = 25\text{ A}$



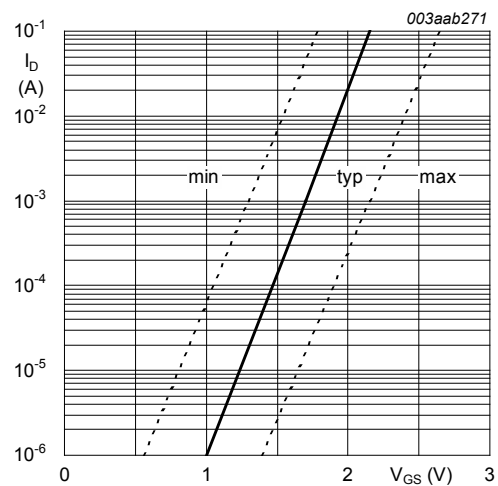
**Fig. 8. Transfer characteristics: drain current as a function of gate-source voltage; typical values**

$V_{DS} > I_D \times R_{DS(on)}$



**Fig. 9. Output characteristics: drain current as a function of drain-source voltage; typical values**

$T_j = 25\text{ }^\circ\text{C}$



**Fig. 10. Sub-threshold drain current as a function of gate-source voltage**

$T_j = 25\text{ }^\circ\text{C}; V_{DS} = 5\text{ V}$



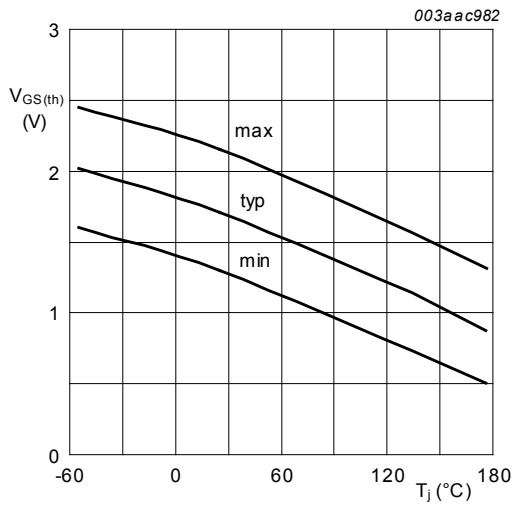


Fig. 11. Gate-source threshold voltage as a function of junction temperature

$$I_D = 1\text{mA}; V_{DS} = V_{GS}$$

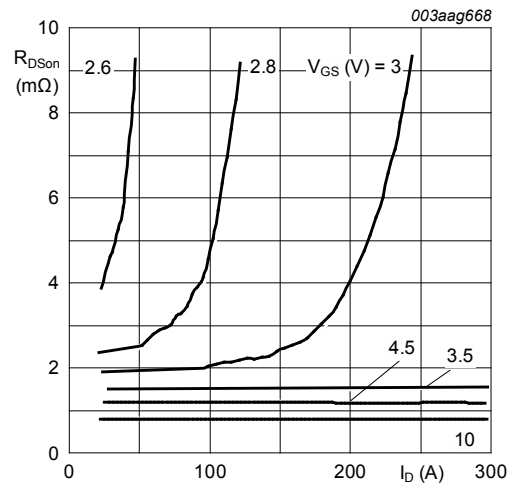


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

$$T_j = 25^\circ\text{C}$$

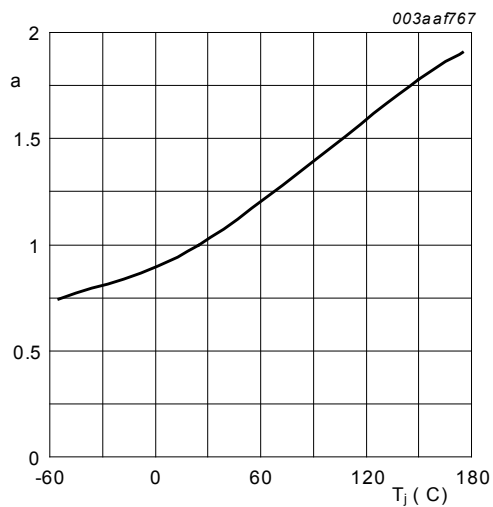


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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

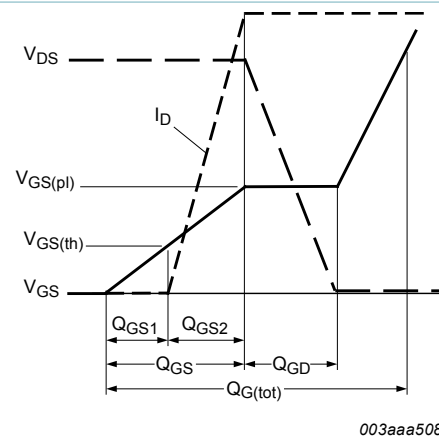


Fig. 14. Gate charge waveform definitions

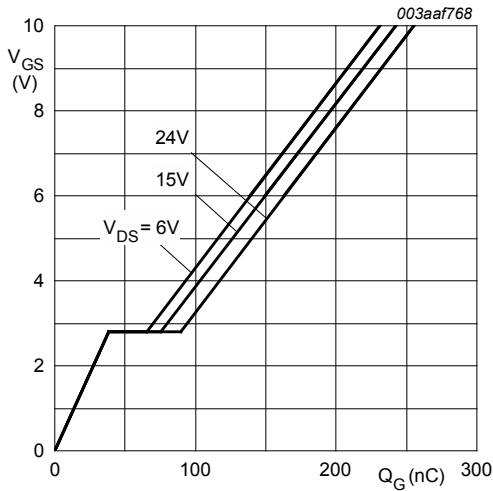


Fig. 15. Gate-source voltage as a function of gate charge; typical values

$T_j = 25\text{ }^\circ\text{C}; I_D = 75\text{ A}$

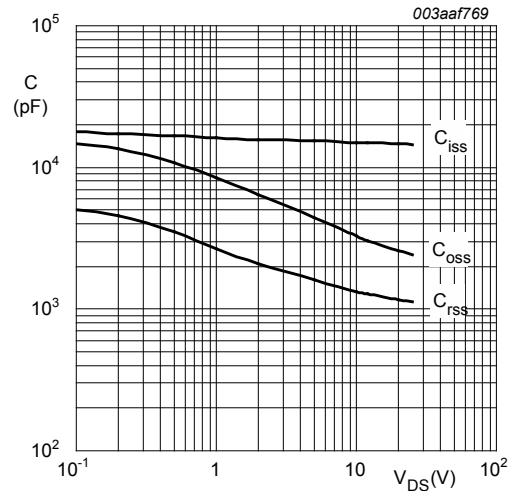


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

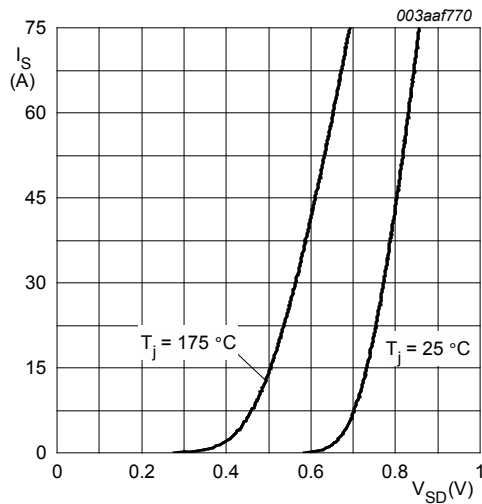


Fig. 17. Source current as a function of source-drain voltage; typical values

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

### 11. Package outline

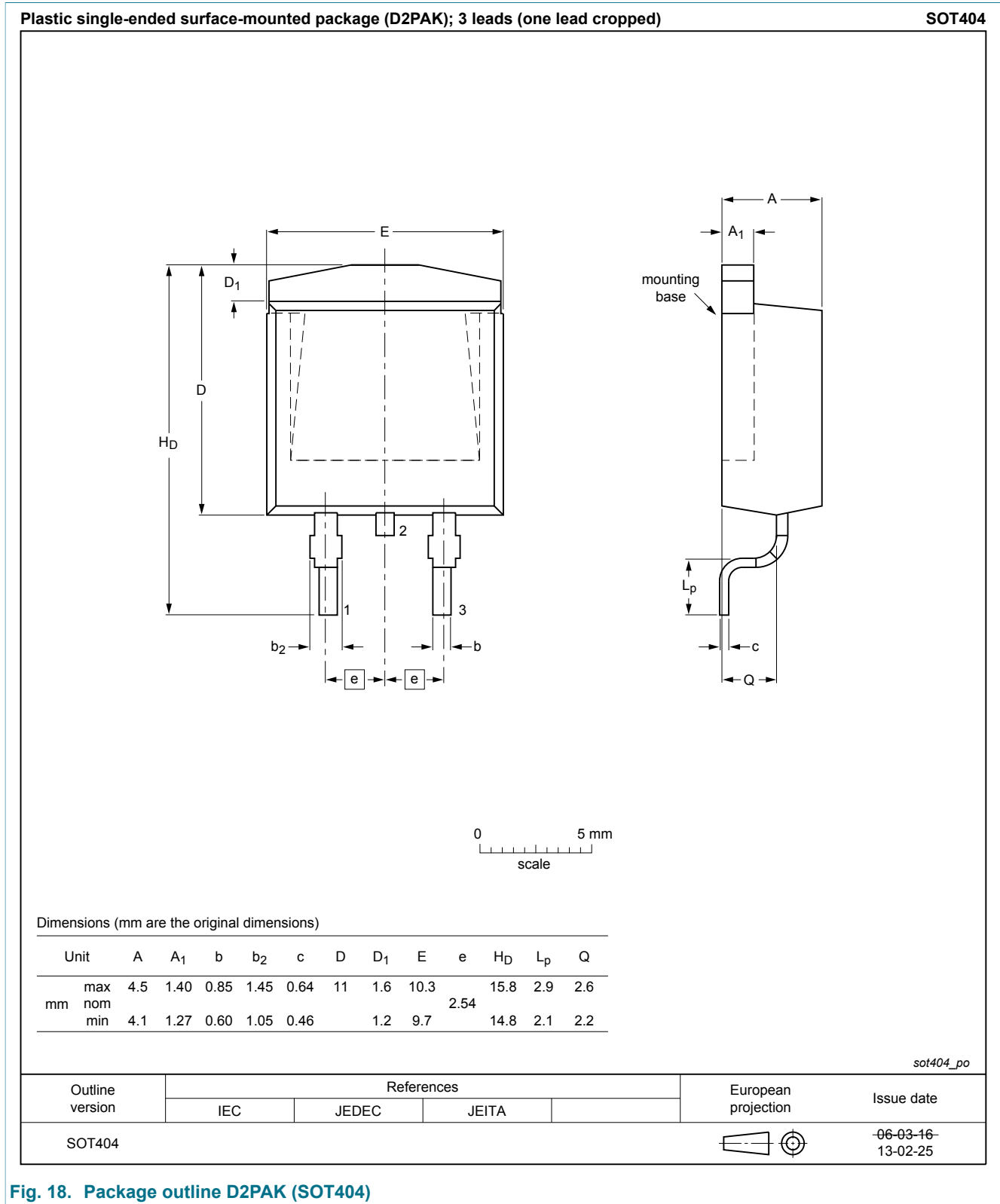


Fig. 18. Package outline D2PAK (SOT404)

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### 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.

- [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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