



# PSMN3R4-30BLE

N-channel 30 V 3.4 mΩ logic level MOSFET in D2PAK

12 October 2012

Product data sheet

## 1. Product profile

### 1.1 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.

### 1.2 Features and benefits

- Enhanced forward biased safe operating area for superior linear mode operation
- Very low  $R_{DSon}$  for low conduction losses

### 1.3 Applications

- Electronic fuse
- Hot swap
- Load switch
- Soft start

### 1.4 Quick reference data

Table 1. Quick reference data

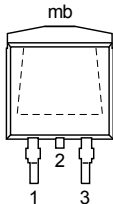
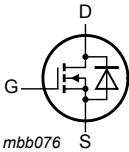
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$		-	-	30	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; <a href="#">Fig. 1</a>	[1]	-	-	120	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 2</a>		-	-	178	W
<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. 12</a>		-	2.95	3.4	mΩ
		$V_{GS} = 4.5\text{ V}$ ; $I_D = 25\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 12</a>		-	4.25	5	mΩ
<b>Dynamic characteristics</b>							
$Q_{GD}$	gate-drain charge	$V_{GS} = 4.5\text{ V}$ ; $I_D = 25\text{ A}$ ; $V_{DS} = 15\text{ V}$ ; <a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a>		-	12.2	-	nC
$Q_{G(tot)}$	total gate charge	$V_{GS} = 10\text{ V}$ ; $I_D = 25\text{ A}$ ; $V_{DS} = 15\text{ V}$ ; <a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a>		-	81	-	nC

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$ ; $T_{j(\text{init})} = 25\text{ °C}$ ; $I_D = 120\text{ A}$ ; $V_{sup} \leq 30\text{ V}$ ; unclamped; $R_{GS} = 50\text{ }\Omega$ ; <a href="#">Fig. 3</a>	-	-	246	mJ

[1] Capped at 120A due to package

## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p><b>D2PAK (SOT404)</b></p>	 <p><i>mbb076</i></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.

## 3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PSMN3R4-30BLE	D2PAK	plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped)	SOT404

## 4. Marking

Table 4. Marking codes

Type number	Marking code
PSMN3R4-30BLE	PSMN3R4-30BLE

## 5. Limiting values

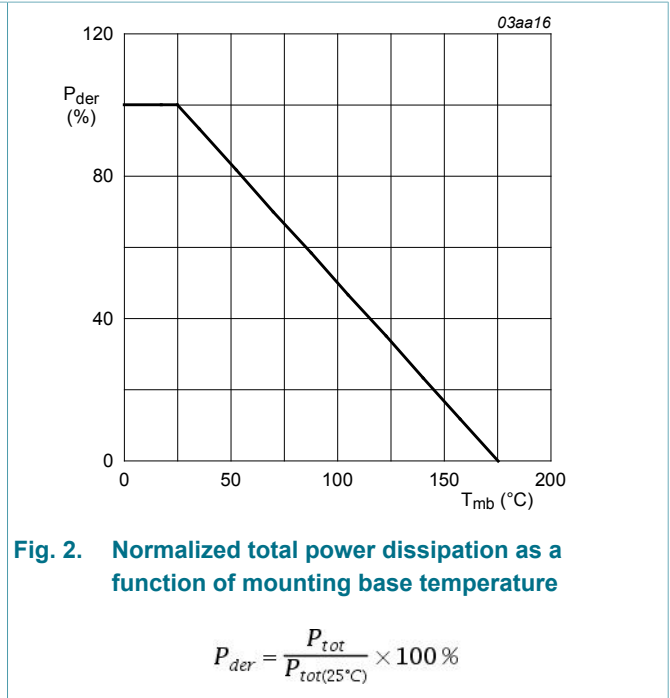
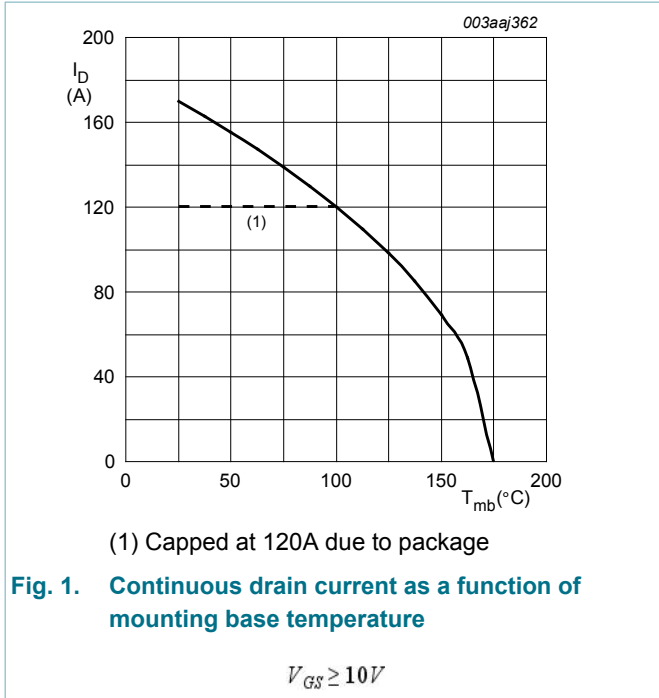
Table 5. Limiting values

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

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

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>GS</sub>	gate-source voltage		-20	20	V
I <sub>D</sub>	drain current	V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 100 °C; <a href="#">Fig. 1</a>	-	119	A
		V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 25 °C; <a href="#">Fig. 1</a>	[1]	120	A
I <sub>DM</sub>	peak drain current	pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C; <a href="#">Fig. 4</a>	-	672	A
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; <a href="#">Fig. 2</a>	-	178	W
T <sub>stg</sub>	storage temperature		-55	175	°C
T <sub>j</sub>	junction temperature		-55	175	°C
T <sub>sld(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	-	672	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(init)</sub> = 25 °C; I <sub>D</sub> = 120 A; V <sub>sup</sub> ≤ 30 V; unclamped; R <sub>GS</sub> = 50 Ω; <a href="#">Fig. 3</a>	-	246	mJ

[1] Capped at 120A due to package



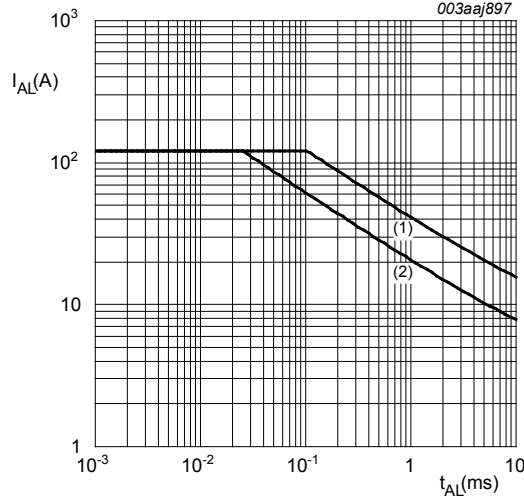


Fig. 3. Single pulse avalanche rating; avalanche current as a function of avalanche time

(1)  $T_{j (int)} = 25^{\circ}C$ ; (2)  $T_{j (int)} = 100^{\circ}C$

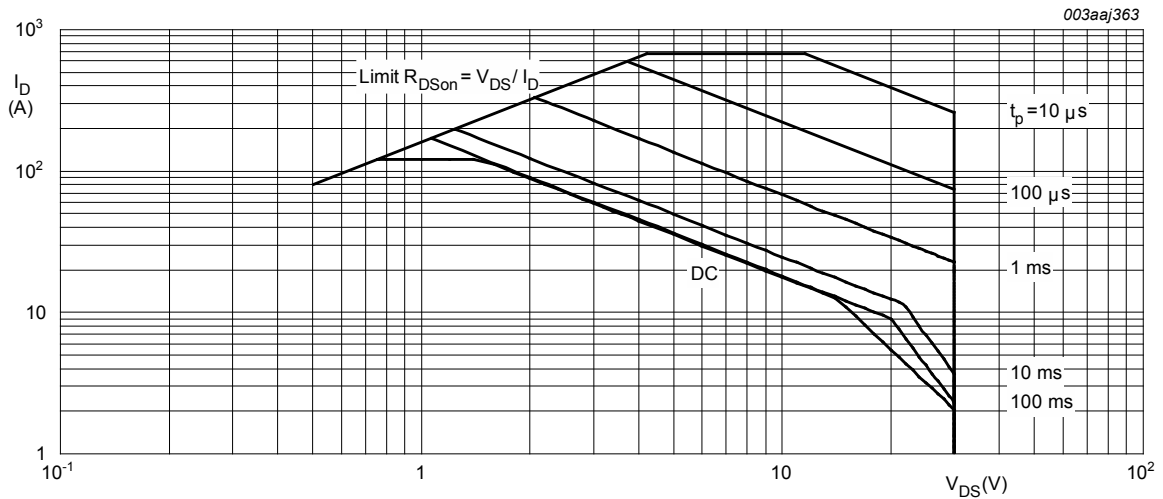


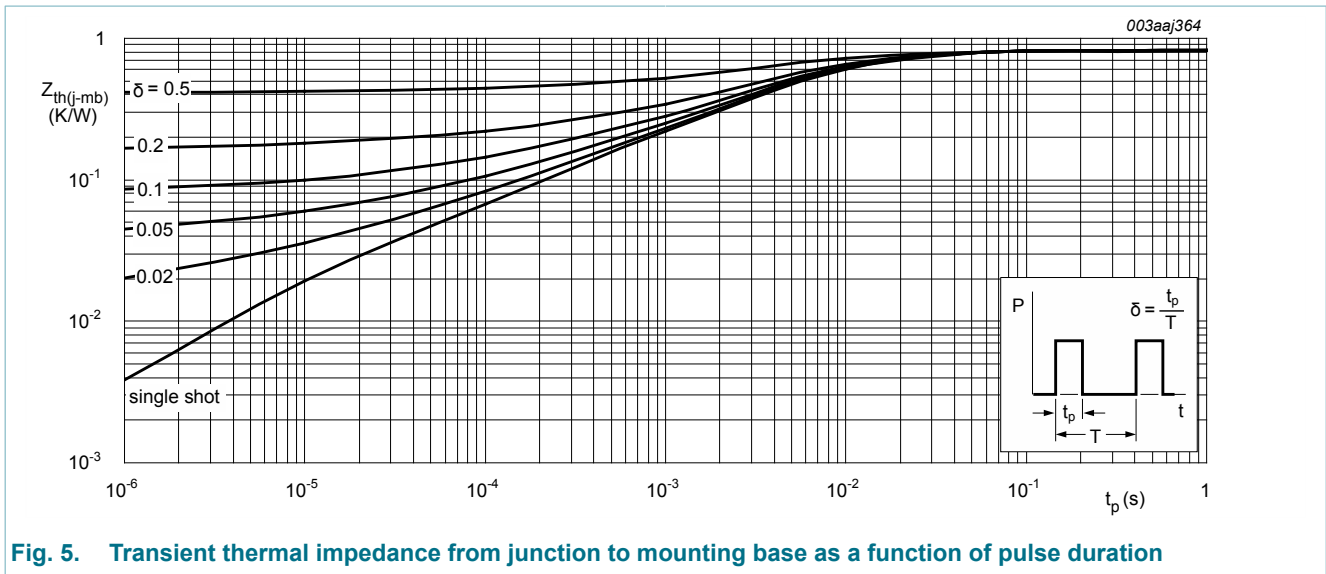
Fig. 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25^{\circ}C$ ;  $I_{DM}$  is a single pulse

## 6. 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. 5	-	0.73	0.84	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	minimum footprint; FR4 board	-	50	-	K/W



## 7. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	27	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	30	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ C;$ <a href="#">Fig. 10</a>	0.5	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C;$ <a href="#">Fig. 11; Fig. 10</a>	1.3	1.7	2.15	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C;$ <a href="#">Fig. 10</a>	-	-	2.45	V
$I_{DSS}$	drain leakage current	$V_{DS} = 30 V; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	-	0.2	5	$\mu A$
		$V_{DS} = 30 V; V_{GS} = 0 V; T_j = 100 \text{ }^\circ C$	-	-	100	$\mu A$
$I_{GSS}$	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
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10 V; I_D = 25 A; T_j = 25 \text{ }^\circ C;$ <a href="#">Fig. 12</a>	-	2.95	3.4	mΩ
		$V_{GS} = 10 V; I_D = 25 A; T_j = 100 \text{ }^\circ C;$ <a href="#">Fig. 13; Fig. 12</a>	-	-	5.1	mΩ
		$V_{GS} = 4.5 V; I_D = 25 A; T_j = 25 \text{ }^\circ C;$ <a href="#">Fig. 12</a>	-	4.25	5	mΩ
		$V_{GS} = 10 V; I_D = 25 A; T_j = 175 \text{ }^\circ C;$ <a href="#">Fig. 13; Fig. 12</a>	-	-	6.5	mΩ

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_G$	internal gate resistance (AC)	$f = 1 \text{ MHz}$	0.5	1	2	$\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(\text{tot})}$	total gate charge	$I_D = 25 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 10 \text{ V};$ <a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a>	-	81	-	nC
		$I_D = 25 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 4.5 \text{ V};$ <a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a>	-	37	-	nC
		$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$	-	79	-	nC
$Q_{GS}$	gate-source charge	$I_D = 25 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 4.5 \text{ V};$ <a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a>	-	13.9	-	nC
$Q_{GS(\text{th})}$	pre-threshold gate-source charge		-	7.5	-	nC
$Q_{GS(\text{th-pl})}$	post-threshold gate-source charge		-	6.4	-	nC
$Q_{GD}$	gate-drain charge		-	12.2	-	nC
$V_{GS(\text{pl})}$	gate-source plateau voltage	$I_D = 25 \text{ A}; V_{DS} = 15 \text{ V};$ <a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a>	-	3.2	-	V
$C_{iss}$	input capacitance	$V_{DS} = 15 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$	-	4682	-	pF
$C_{oss}$	output capacitance	$T_j = 25 \text{ }^\circ\text{C};$ <a href="#">Fig. 16</a>	-	909	-	pF
$C_{rss}$	reverse transfer capacitance		-	438	-	pF
$t_{d(\text{on})}$	turn-on delay time	$V_{DS} = 15 \text{ V}; R_L = 0.6 \text{ } \Omega; V_{GS} = 4.5 \text{ V};$	-	35.7	-	ns
$t_r$	rise time	$R_{G(\text{ext})} = 4.7 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$	-	101	-	ns
$t_{d(\text{off})}$	turn-off delay time		-	49	-	ns
$t_f$	fall time		-	51.2	-	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>	-	0.85	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 25 \text{ A}; di_S/dt = 100 \text{ A}/\mu\text{s}; V_{GS} = 0 \text{ V};$	-	37	-	ns
$Q_r$	recovered charge	$V_{DS} = 15 \text{ V}$	-	38	-	nC

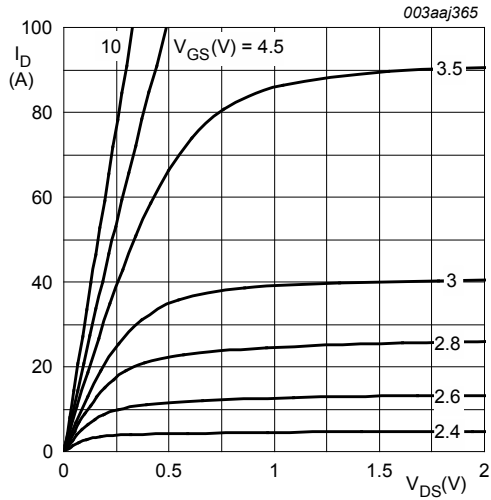


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

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

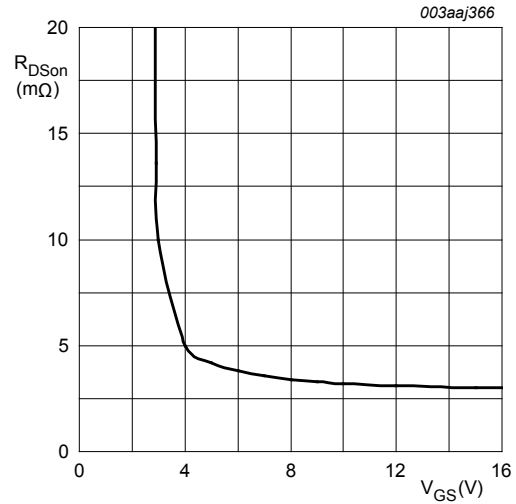


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

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

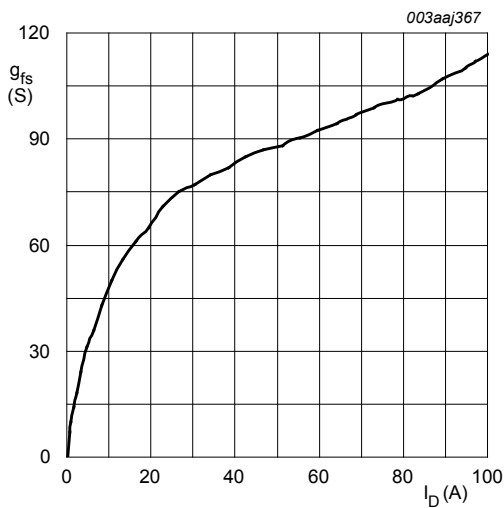


Fig. 8. Forward transconductance as a function of drain current; typical values

$T_j = 25^\circ\text{C}; V_{DS} = 10\text{V}$

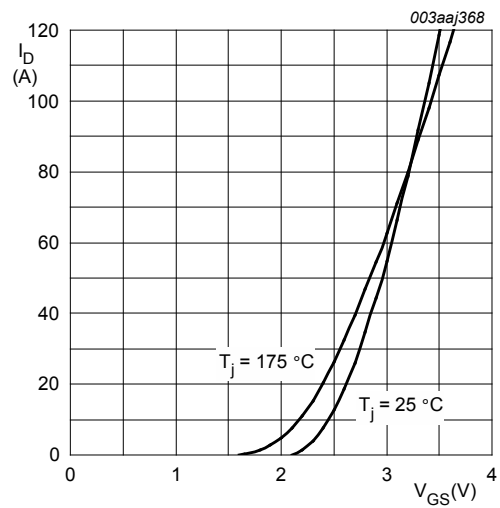


Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

$V_{DS} = 10\text{V}$

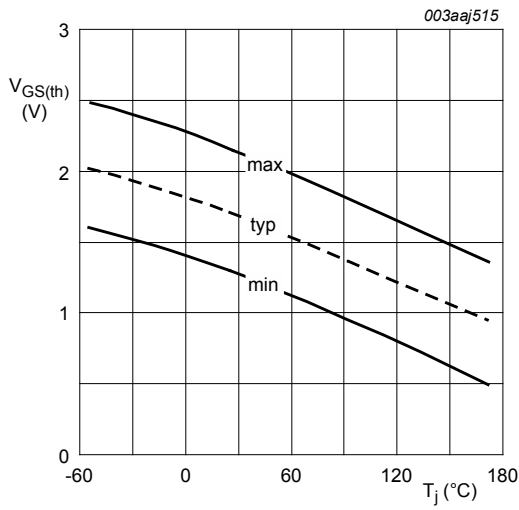


Fig. 10. Gate-source threshold voltage as a function of junction temperature

$$V_{DS} = V_{GS}$$

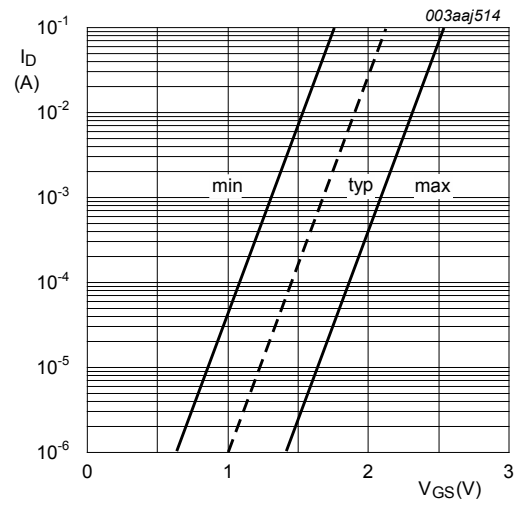


Fig. 11. Sub-threshold drain current as a function of gate-source voltage

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

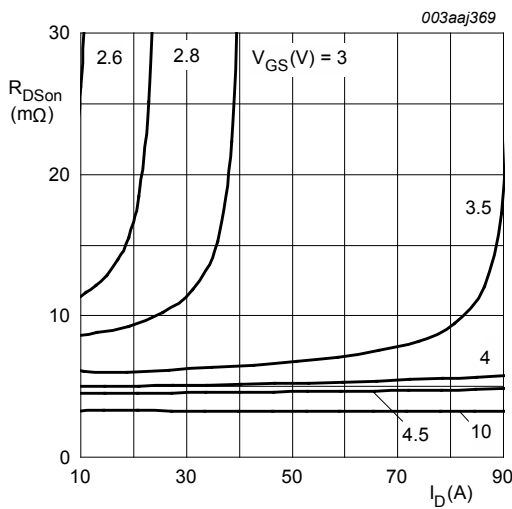


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

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

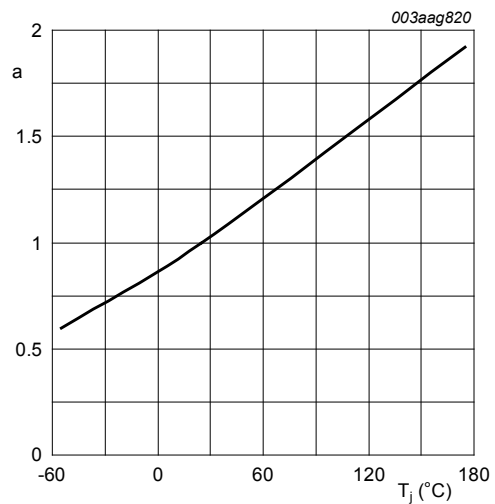


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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



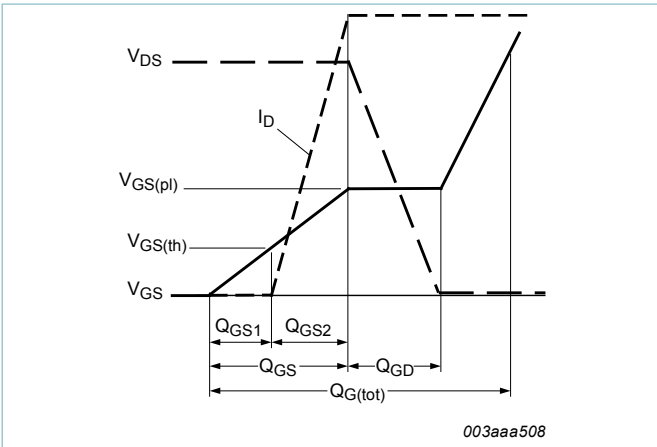


Fig. 14. Gate charge waveform definitions

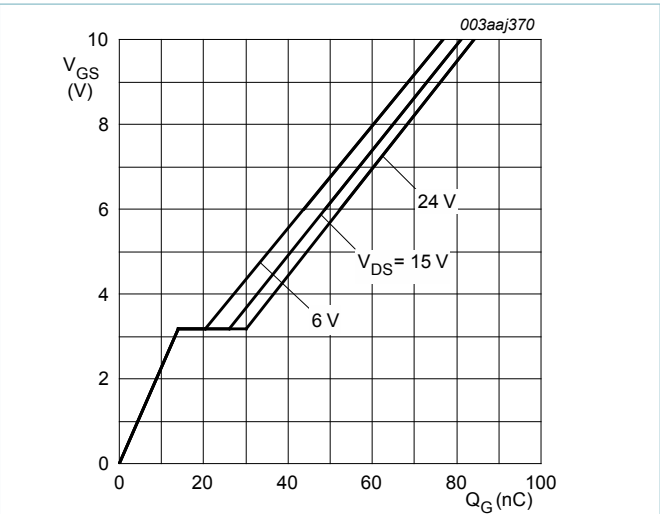


Fig. 15. Gate-source voltage as a function of gate charge; typical values

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

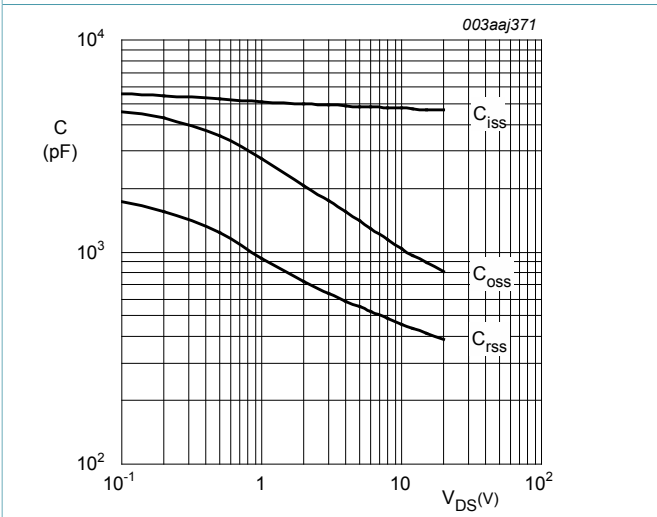


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

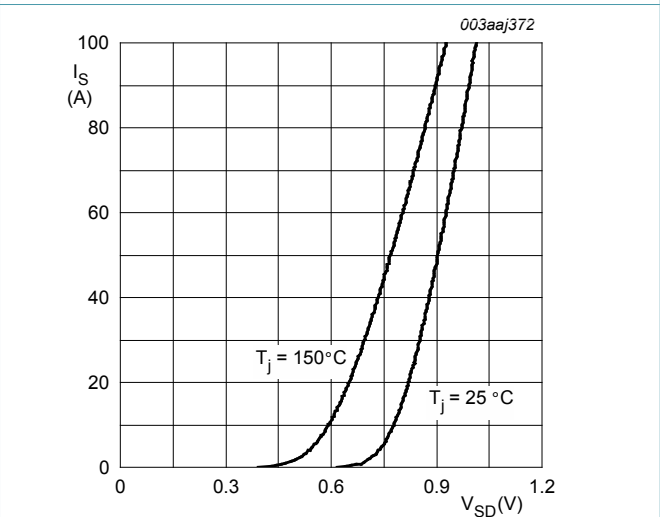


Fig. 17. Source current as a function of source-drain voltage; typical values

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

8. Package outline

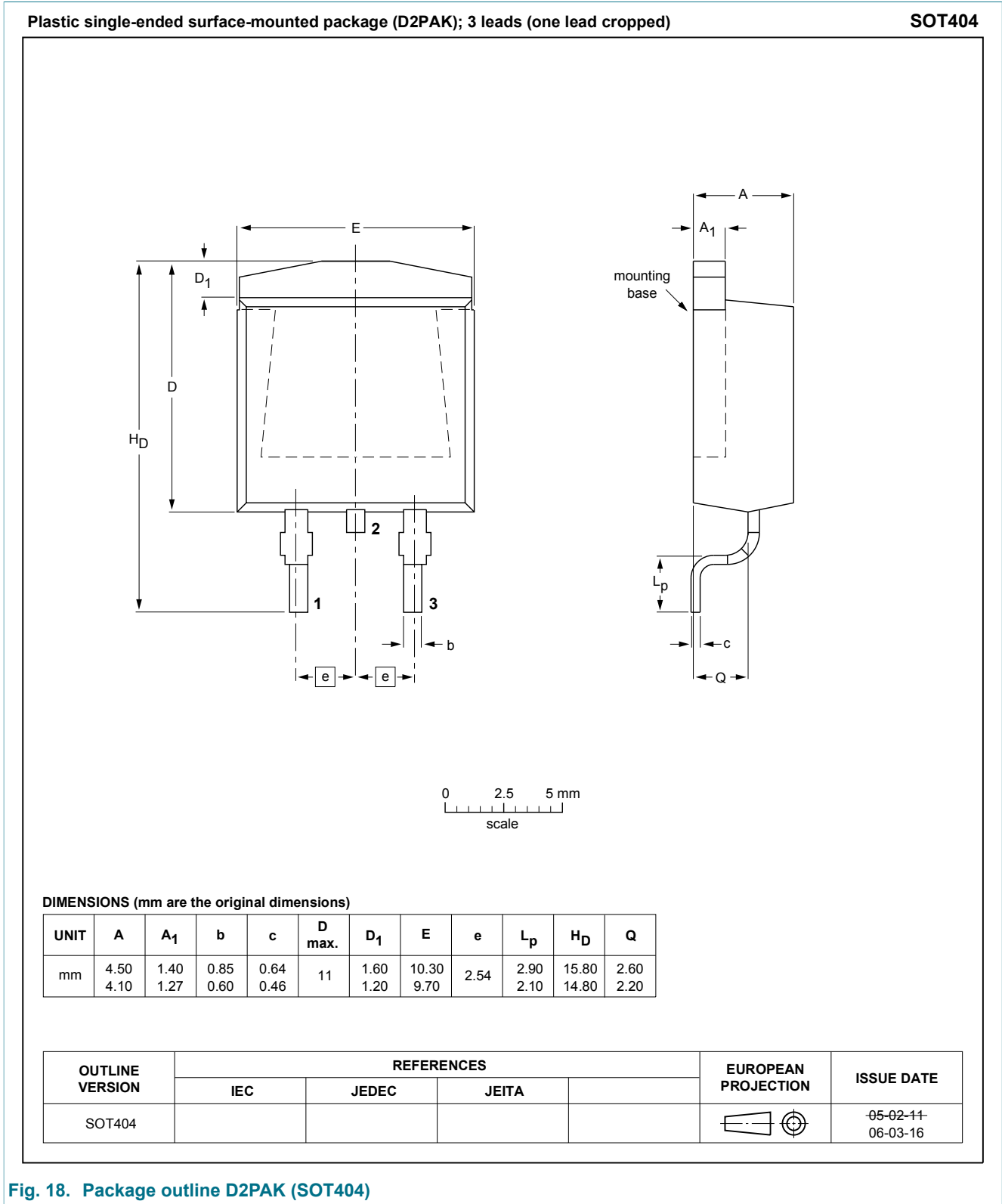


Fig. 18. Package outline D2PAK (SOT404)

## 9. Legal information

### 9.1 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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