



# PSMN4R3-80ES

N-channel 80 V, 4.3 mΩ standard level MOSFET in I2PAK

Rev. 02 — 18 April 2011

Product data sheet

## 1. Product profile

### 1.1 General description

Standard level N-channel MOSFET in I2PAK 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

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

### 1.3 Applications

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

### 1.4 Quick reference data

Table 1. Quick reference data

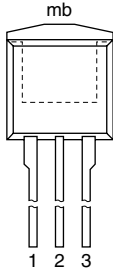
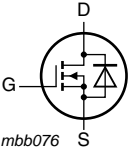
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	80	V	
$I_D$	drain current	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ see <a href="#">Figure 1</a>	<a href="#">[1]</a>	-	120	A	
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C};$ see <a href="#">Figure 2</a>	-	-	306	W	
$T_j$	junction temperature		-55	-	175	°C	
<b>Static characteristics</b>							
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A};$ $T_j = 25\text{ °C};$ see <a href="#">Figure 13</a>	<a href="#">[2]</a>	-	3.7	4.3	mΩ
		$V_{GS} = 10\text{ V}; I_D = 25\text{ A};$ $T_j = 100\text{ °C};$ see <a href="#">Figure 12</a>	<a href="#">[2]</a>	-	6.1	7.1	mΩ
<b>Dynamic characteristics</b>							
$Q_{GD}$	gate-drain charge	$V_{GS} = 10\text{ V}; I_D = 75\text{ A};$	-	28	-	nC	
$Q_{G(tot)}$	total gate charge	$V_{DS} = 40\text{ V};$ see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	111	-	nC	
<b>Avalanche ruggedness</b>							
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(init)} = 25\text{ °C};$ $I_D = 120\text{ A}; V_{sup} \leq 80\text{ V};$ $R_{GS} = 50\text{ Ω};$ unclamped	-	-	676	mJ	

[1] Continuous current is limited by package.

[2] Measured 3 mm from package.

## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate		
2	D	drain		
3	S	source		
mb	D	drain		

**SOT226 (I2PAK)**

## 3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PSMN4R3-80ES	I2PAK	plastic single-ended package (I2PAK); TO-262	SOT226

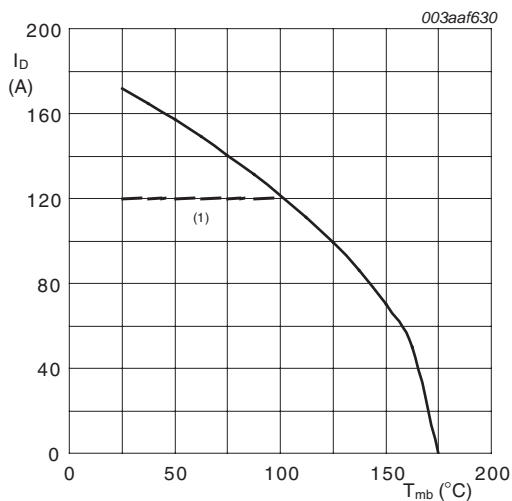
## 4. Limiting values

**Table 4. Limiting values**

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

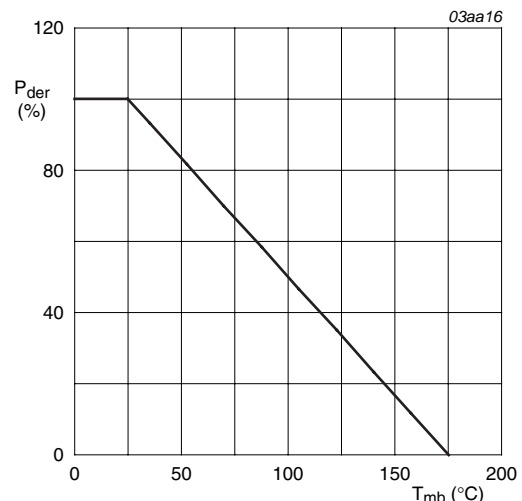
Symbol	Parameter	Conditions	Min	Max	Unit	
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	80	V	
$V_{DGR}$	drain-gate voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}; R_{GS} = 20\text{ k}\Omega$	-	80	V	
$V_{GS}$	gate-source voltage		-20	20	V	
$I_D$	drain current	$V_{GS} = 10\text{ V}; T_{mb} = 100\text{ °C}$ ; see <a href="#">Figure 1</a>	[1]	-	120	A
		$V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a>	[1]	-	120	A
$I_{DM}$	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 3</a>	-	688	A	
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	306	W	
$T_{stg}$	storage temperature		-55	175	°C	
$T_j$	junction temperature		-55	175	°C	
$T_{sld(M)}$	peak soldering temperature		-	260	°C	
<b>Source-drain diode</b>						
$I_S$	source current	$T_{mb} = 25\text{ °C}$	[1]	-	120	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$	-	688	A	
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ °C}; I_D = 120\text{ A}; V_{sup} \leq 80\text{ V}; R_{GS} = 50\text{ }\Omega$ ; unclamped	-	676	mJ	

[1] Continuous current is limited by package.



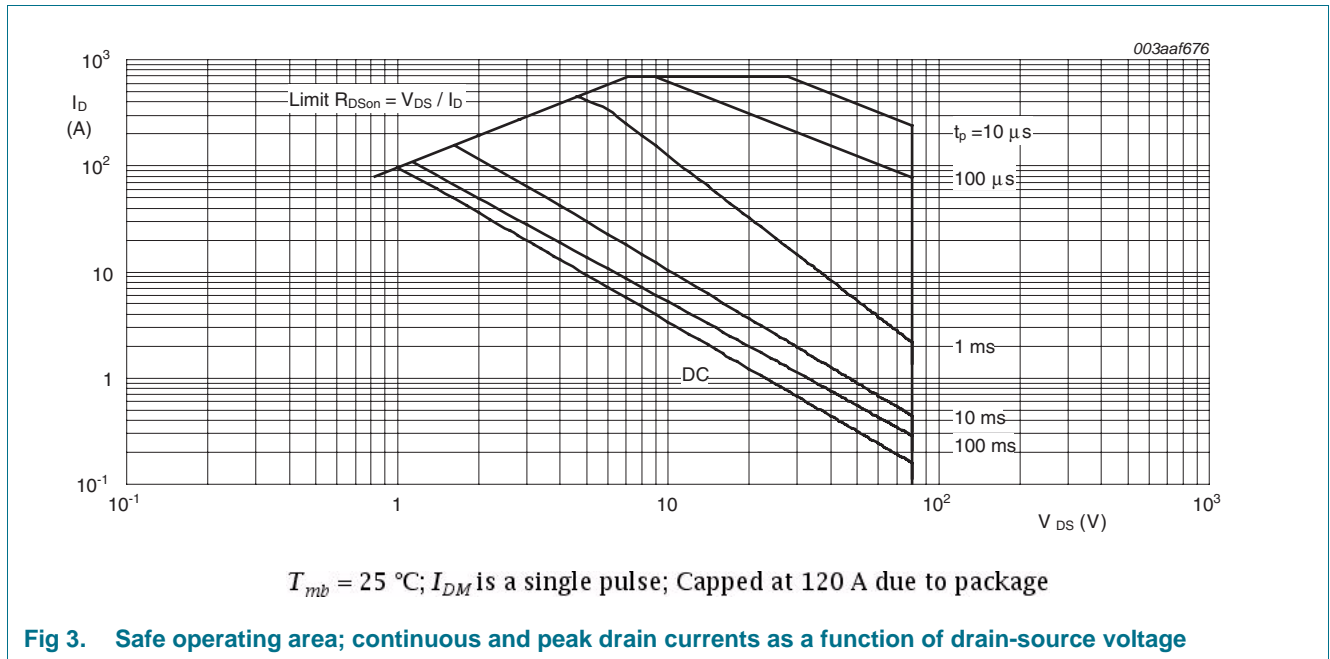
$V_{GS} \geq 10\text{ V}$ ; (1) capped at 120 A due to package.

**Fig 1. Continuous drain current as a function of mounting base temperature**



$$P_{der} = \frac{P_{tot}}{P_{tot(25\text{ °C})}} \times 100\%$$

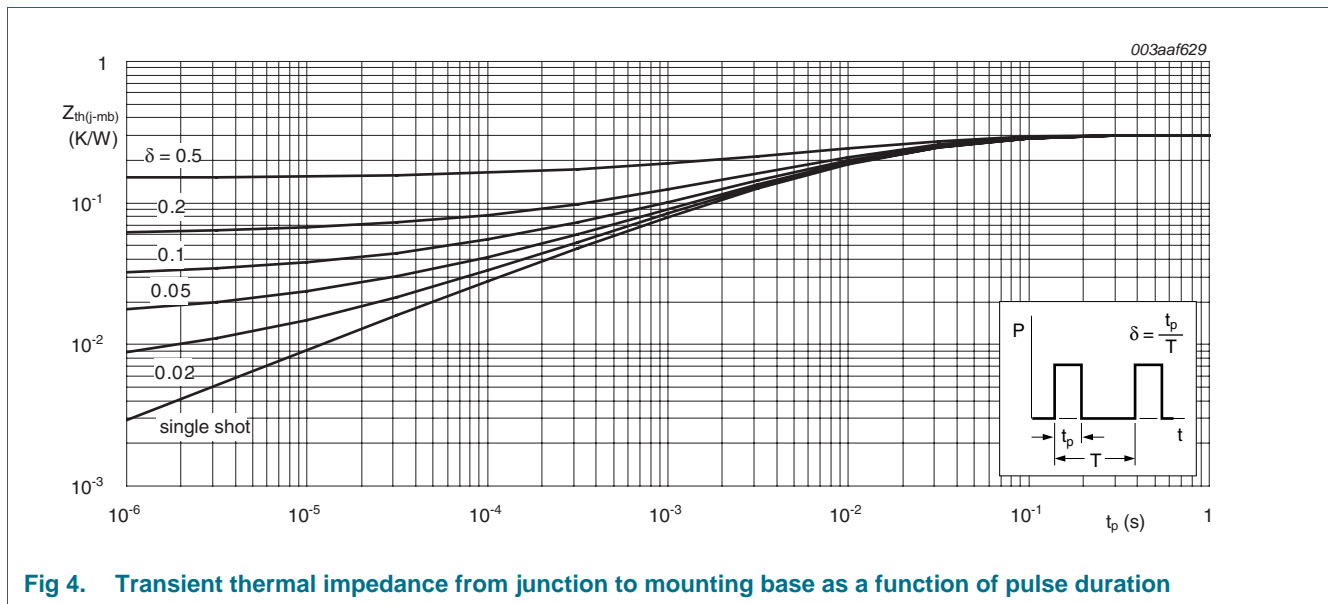
**Fig 2. Normalized total power dissipation as a function of mounting base temperature**



### 5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see <a href="#">Figure 4</a>	-	0.22	0.49	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	Vertical in free air	-	60	-	K/W



## 6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
<b>Static characteristics</b>							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	73	-	-	V	
		$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	80	-	-	V	
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ see <a href="#">Figure 10</a>	1	-	-	V	
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see <a href="#">Figure 10</a>	-	-	4.6	V	
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	2	3	4	V	
$I_{DSS}$	drain leakage current	$V_{DS} = 80 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.02	10	$\mu\text{A}$	
		$V_{DS} = 80 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$	-	-	500	$\mu\text{A}$	
$I_{GSS}$	gate leakage current	$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	100	nA	
		$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	100	nA	
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see <a href="#">Figure 12</a>	[1]	-	8.9	10.3	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 13</a>	[1]	-	3.7	4.3	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 100 \text{ }^\circ\text{C};$ see <a href="#">Figure 12</a>	[1]	-	6.1	7.1	mΩ
$R_G$	internal gate resistance (AC)	$f = 1 \text{ MHz}$	-	0.9	-	Ω	
<b>Dynamic characteristics</b>							
$Q_{G(tot)}$	total gate charge	$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$	-	104	-	nC	
		$I_D = 75 \text{ A}; V_{DS} = 40 \text{ V}; V_{GS} = 10 \text{ V};$ see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	111	-	nC	
$Q_{GS}$	gate-source charge		-	38	-	nC	
$Q_{GS(th)}$	pre-threshold gate-source charge		-	24	-	nC	
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	14	-	nC	
$Q_{GD}$	gate-drain charge		-	28	-	nC	
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 25 \text{ A}; V_{DS} = 40 \text{ V};$ see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	6.1	-	V	
$C_{iss}$	input capacitance	$V_{DS} = 40 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 16</a>	-	8161	-	pF	
$C_{oss}$	output capacitance		-	701	-	pF	
$C_{rss}$	reverse transfer capacitance		-	337	-	pF	
$t_{d(on)}$	turn-on delay time	$V_{DS} = 40 \text{ V}; R_L = 0.53 \text{ } \Omega;$	-	38	-	ns	
$t_r$	rise time	$V_{GS} = 10 \text{ V}; R_{G(ext)} = 4.7 \text{ } \Omega;$ $I_D = 75 \text{ A}$	-	29	-	ns	
$t_{d(off)}$	turn-off delay time		-	94	-	ns	
$t_f$	fall time		-	33	-	ns	

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 25 \text{ A}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 17</a>	-	0.8	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 25 \text{ A}$ ; $di_S/dt = 100 \text{ A}/\mu\text{s}$ ;	-	59	-	ns
$Q_r$	recovered charge	$V_{GS} = 0 \text{ V}$ ; $V_{DS} = 20 \text{ V}$	-	109	-	nC

[1] Measured 3 mm from package.

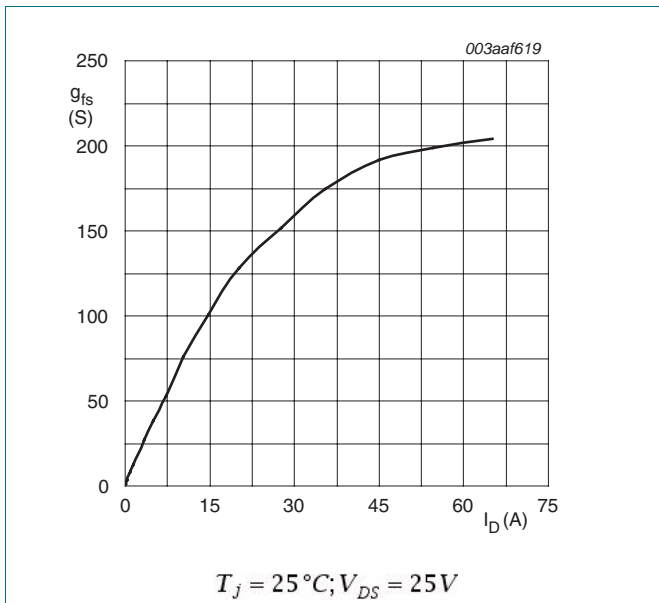


Fig 5. Forward transconductance as a function of drain current; typical values

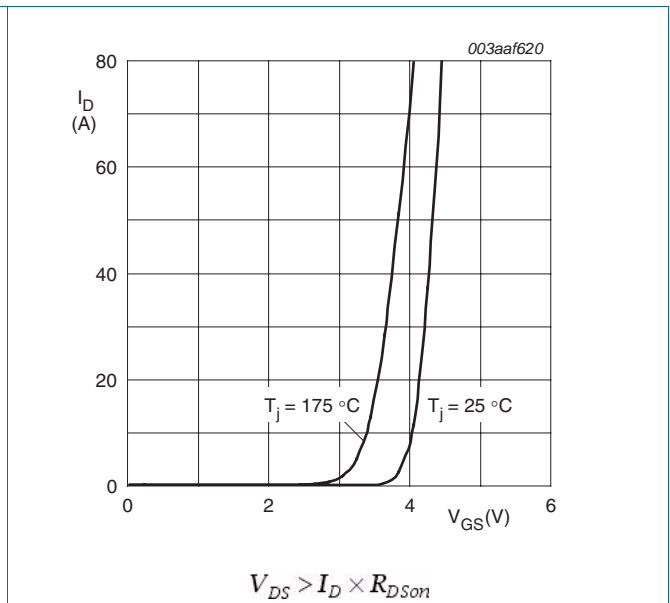


Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values

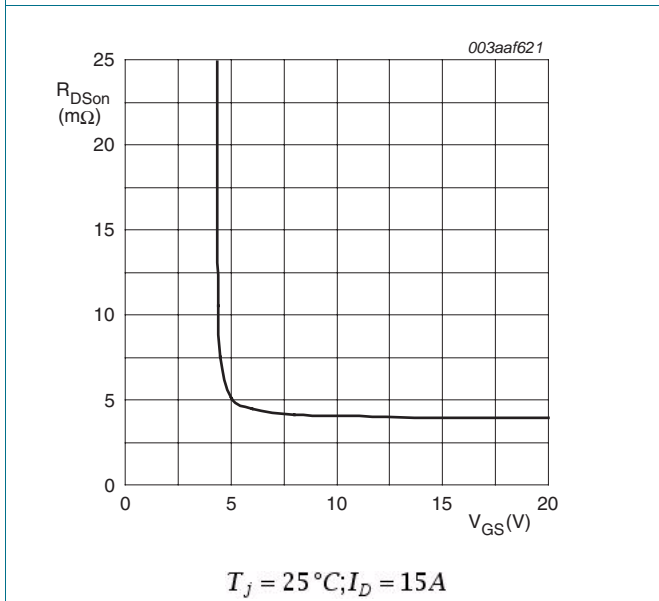


Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

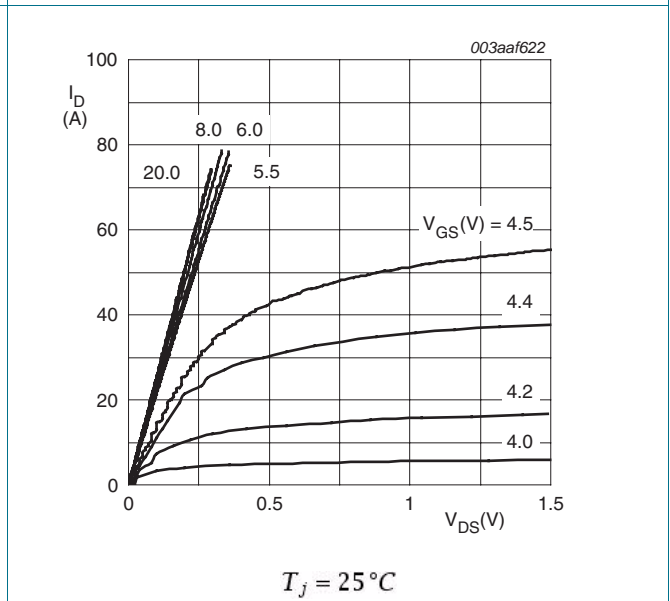
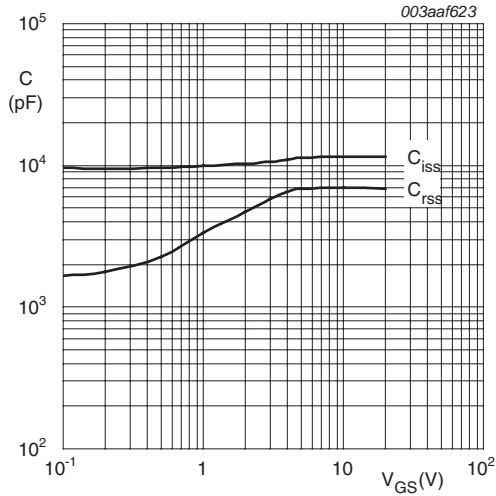
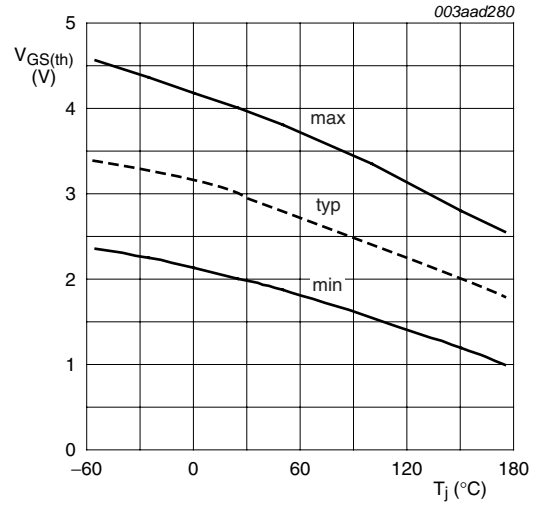


Fig 8. Output characteristics: drain current as a function of drain-source voltage; typical values



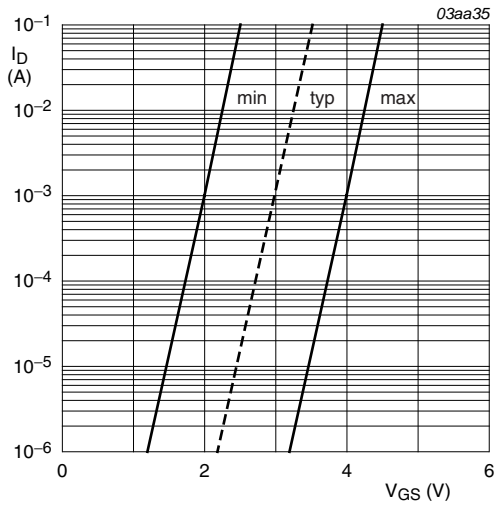
$$V_{DS} = 0V; f = 1MHz$$

Fig 9. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



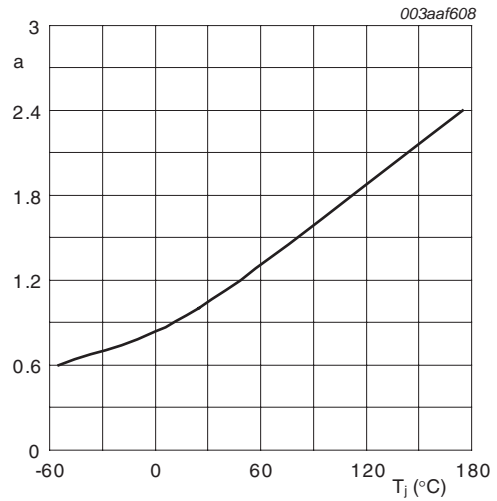
$$I_D = 1\text{ mA}; V_{DS} = V_{GS}$$

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



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

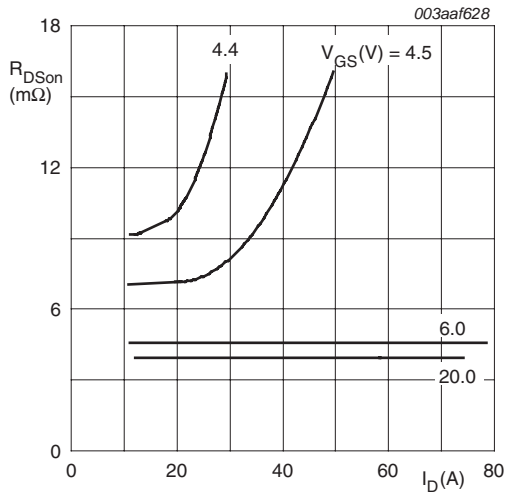
Fig 11. Sub-threshold drain current as a function of gate-source voltage



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

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





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

Fig 13. Drain-source on-state resistance as a function of drain current; typical values

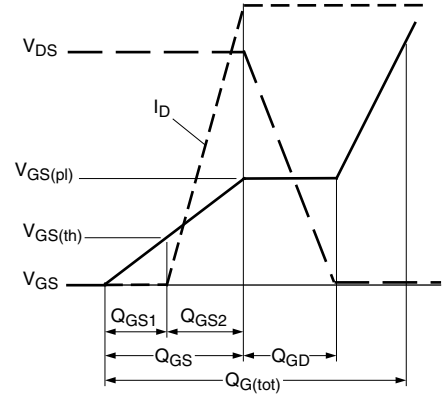
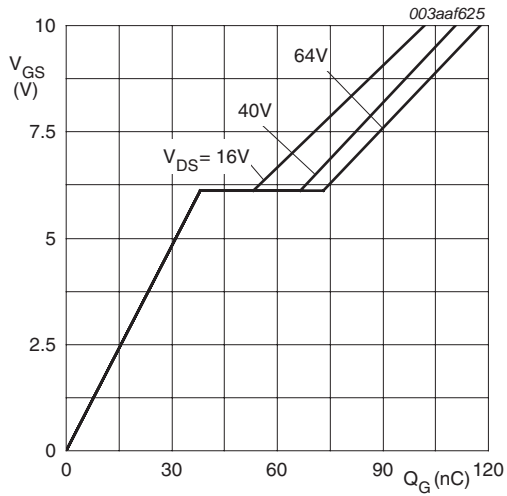
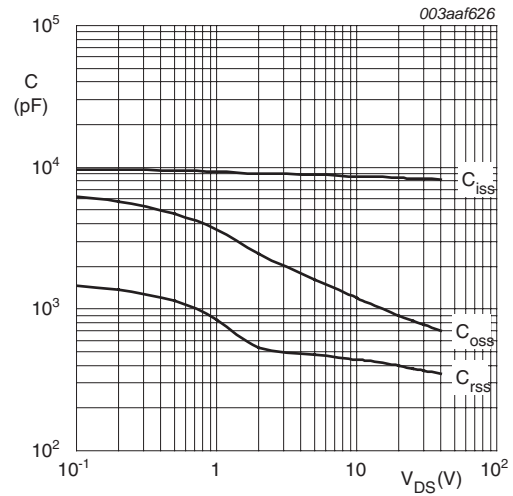


Fig 14. Gate charge waveform definitions



$I_D = 75\text{A}$

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



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

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

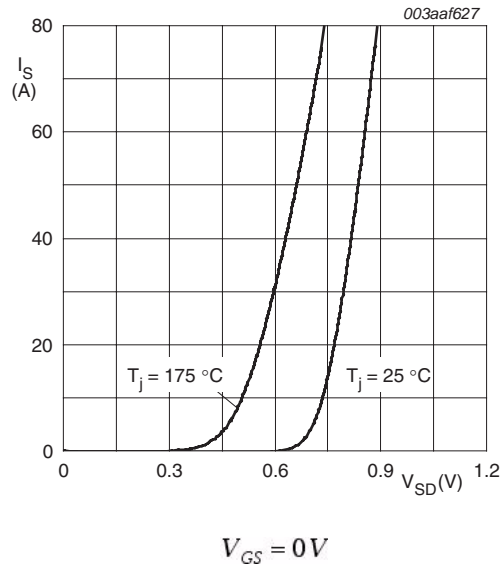


Fig 17. Source current as a function of source-drain voltage; typical values

7. Package outline

Plastic single-ended package (I2PAK); low-profile 3-lead TO-262

SOT226

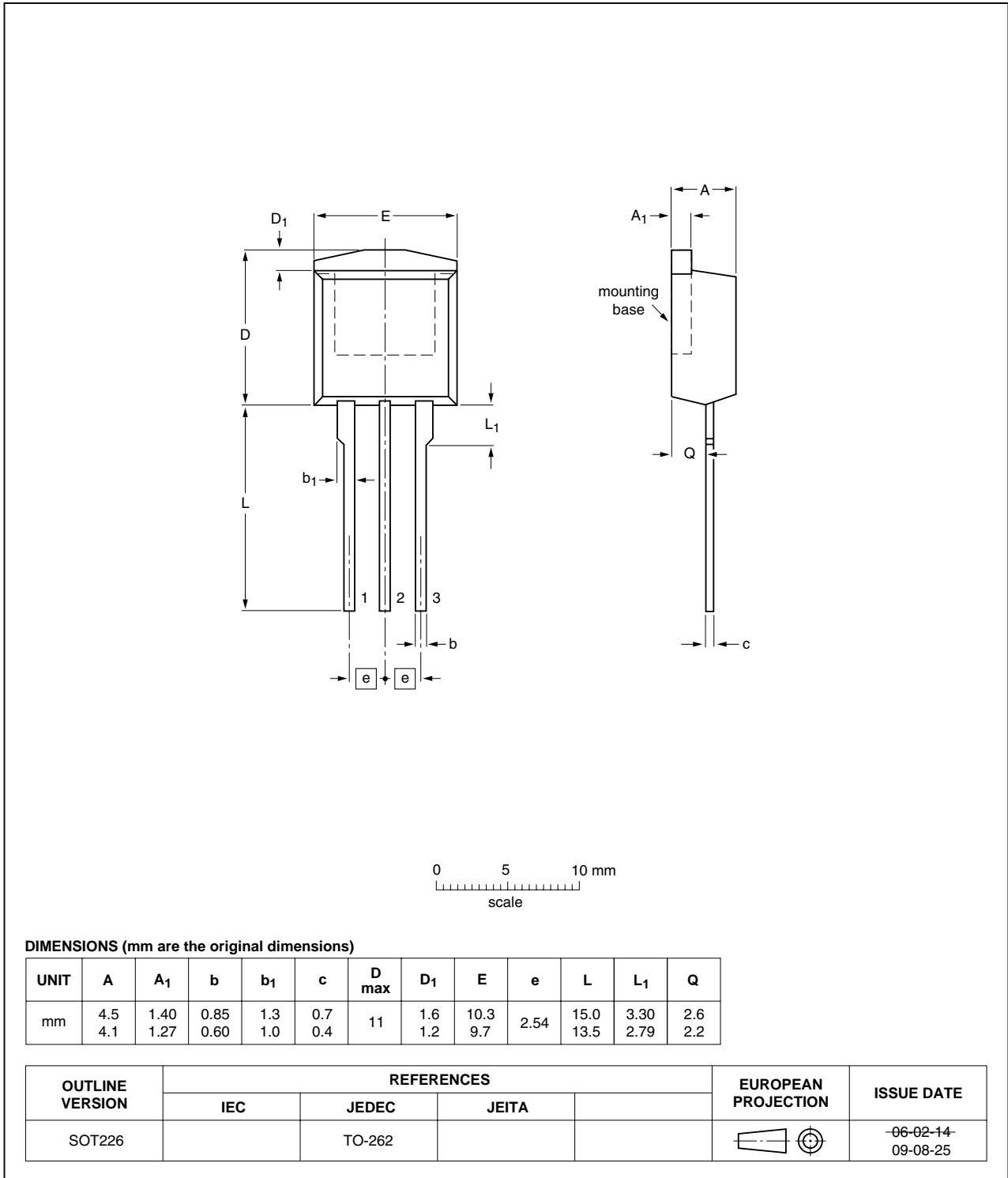


Fig 18. Package outline SOT226 (I2PAK)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN4R3-80ES v.2	20110418	Product data sheet	-	PSMN4R3-80ES v.1
Modifications:	<ul style="list-style-type: none"><li>• Status changed from objective to product.</li><li>• Various changes to content.</li></ul>			
PSMN4R3-80ES v.1	20101228	Objective data sheet	-	-

## 9. Legal information

### 9.1 Data sheet status

Document status <a href="#">[1]</a> <a href="#">[2]</a>	Product status <a href="#">[3]</a>	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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