



PSMN013-100ES

N-channel 100V 13.9mΩ standard level MOSFET in I2PAK.

Rev. 3 — 29 September 2011

Product data sheet

1. Product profile

1.1 General description

Standard level N-channel enhancement MOSFET in I2PAK package qualified to 175C. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

1.2 Features and benefits

- Low conduction losses due to low on-state resistance
- Suitable for high frequency applications due to fast switching characteristics

1.3 Applications

- DC-to-DC converters
- Motor control
- Load switching
- 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	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	100	V
I_D	drain current	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ see Figure 1	[1]	-	68	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C};$ see Figure 2	-	-	170	W
T_j	junction temperature		-55	-	175	°C
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 15\text{ A};$ $T_j = 100\text{ °C};$ see Figure 11	-	-	25	mΩ
		$V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 25\text{ °C};$ [2] see Figure 12 ; see Figure 11	-	11	13.9	mΩ
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 10\text{ V}; I_D = 25\text{ A};$ $V_{DS} = 50\text{ V};$ see Figure 14 ; see Figure 13	-	17	-	nC

Table 1. Quick reference data ...continued

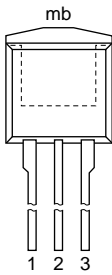
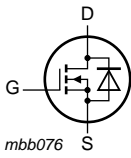
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$Q_{G(\text{tot})}$	total gate charge	$V_{GS} = 10 \text{ V}$; $I_D = 25 \text{ A}$; $V_{DS} = 50 \text{ V}$; see Figure 13 ; see Figure 14	-	59	-	nC
Avalanche ruggedness						
$E_{DS(\text{AL})S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10 \text{ V}$; $T_{j(\text{init})} = 25 \text{ °C}$; $I_D = 68 \text{ A}$; $V_{\text{sup}} \leq 100 \text{ V}$; unclamped; $R_{GS} = 50 \text{ } \Omega$	-	-	127	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	mounting base; connected to drain		

SOT226 (I2PAK)

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PSMN013-100ES	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	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	100	V
V_{DGR}	drain-gate voltage	$T_j \leq 175\text{ °C}$; $T_j \geq 25\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	100	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ °C}$; see Figure 1 ^[1]	-	47	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 1 ^[1]	-	68	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$	-	272	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	170	W
T_{stg}	storage temperature		-55	175	°C
T_j	junction temperature		-55	175	°C
$T_{slid(M)}$	peak soldering temperature		-	260	°C
Source-drain diode					
I_S	source current	$T_{mb} = 25\text{ °C}$	^[1] -	68	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$	-	272	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 68\text{ A}$; $V_{sup} \leq 100\text{ V}$; unclamped; $R_{GS} = 50\text{ }\Omega$	-	127	mJ

[1] Continuous current is limited by package.

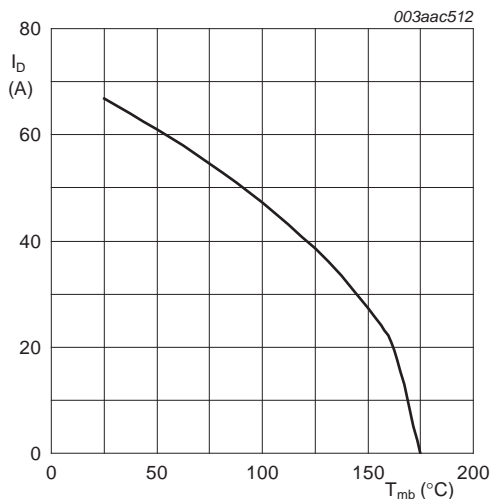


Fig 1. Continuous drain current as a function of mounting base temperature

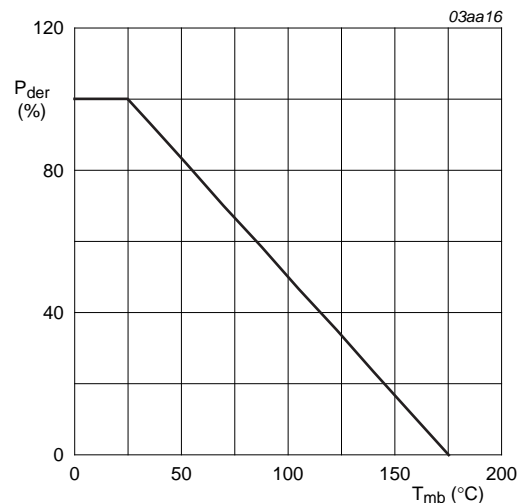


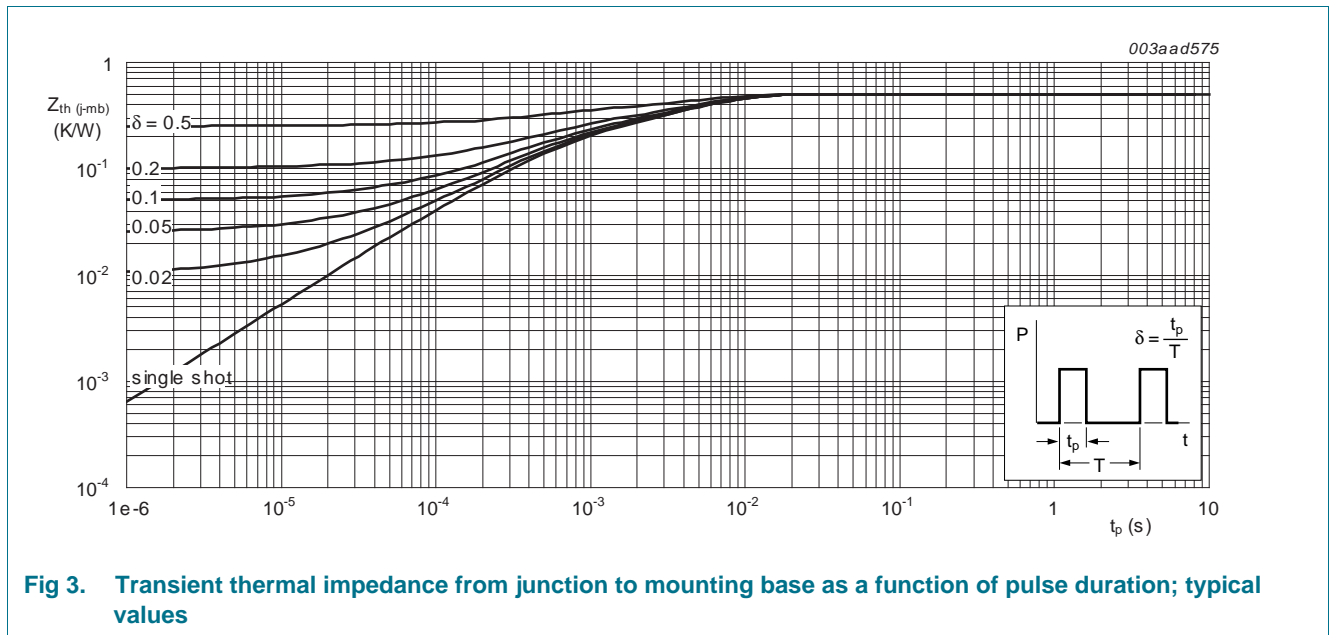
Fig 2. Normalized total power dissipation as a function of mounting base temperature

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

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 Figure 3	-	0.5	0.9	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	vertical in free air	-	60	-	K/W



6. Characteristics

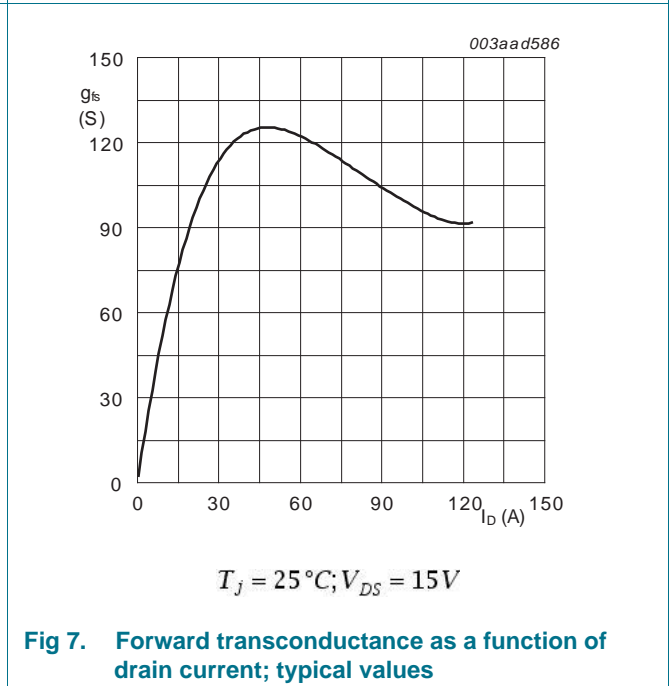
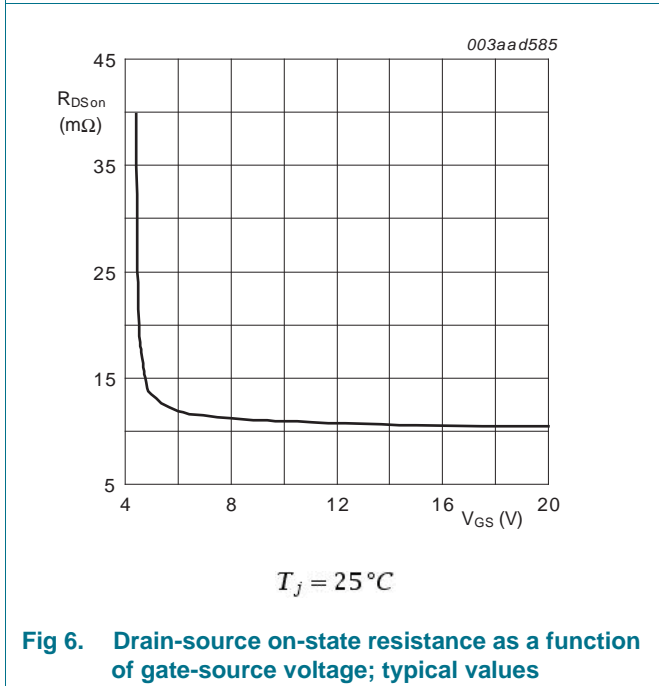
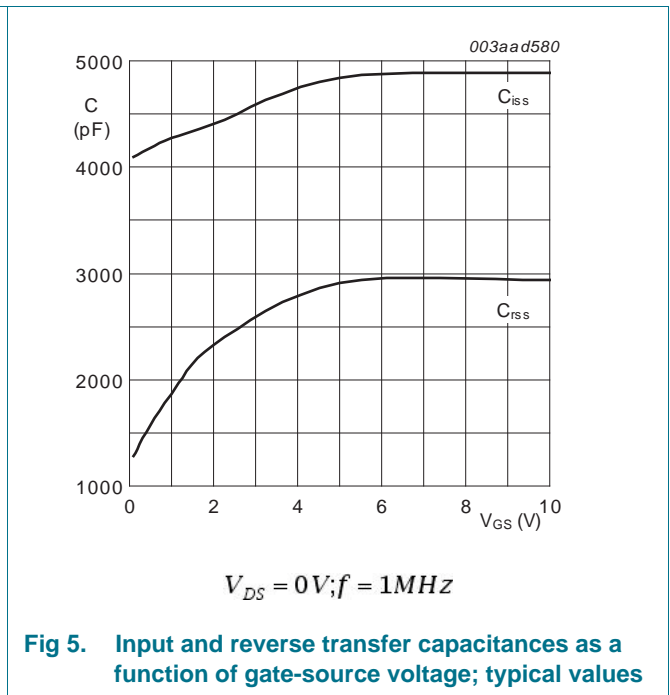
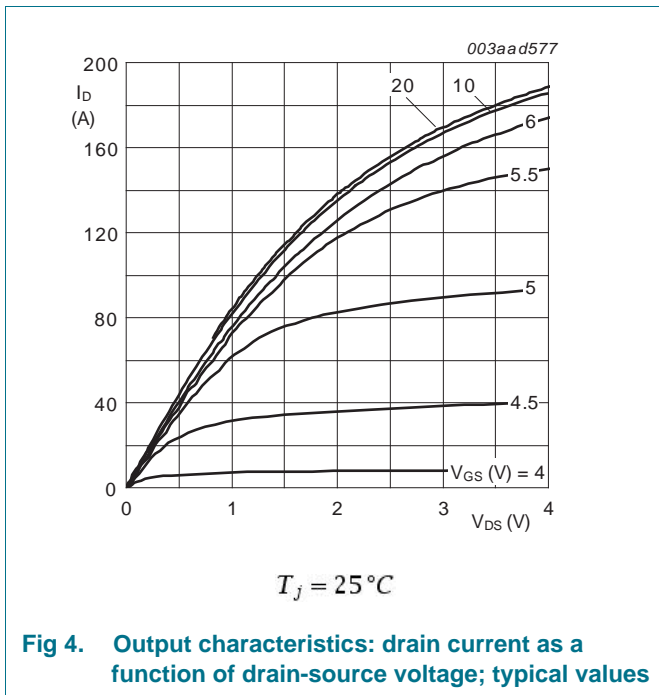
Table 6. Characteristics

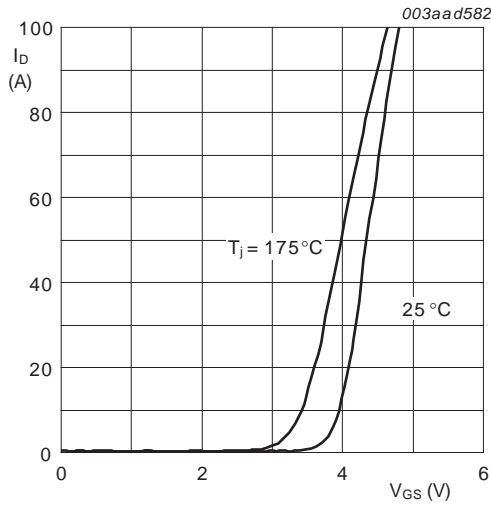
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ °C}$	90	-	-	V
		$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ °C}$	100	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ °C};$ see Figure 9	1	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ °C};$ see Figure 10 ; see Figure 9	2	3	4	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ °C};$ see Figure 10	-	-	4.8	V
I_{DSS}	drain leakage current	$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ °C}$	-	-	100	μA
		$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ °C}$	-	0.06	2	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ °C}$	-	10	100	nA
		$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ °C}$	-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 175 \text{ °C};$ see Figure 11	-	30	38.9	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 100 \text{ °C};$ see Figure 11	-	-	25	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ °C};$ see Figure 12 ; see Figure 11	11	-	11	13.9
R_G	internal gate resistance (AC)	$f = 1 \text{ MHz}$	-	1	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 25 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V};$ see Figure 13 ; see Figure 14	-	59	-	nC
		$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$	-	47.6	-	nC
Q_{GS}	gate-source charge	$I_D = 25 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V};$ see Figure 13 ; see Figure 14	-	13.8	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge	$I_D = 25 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V};$ see Figure 14	-	9.2	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	4.6	-	nC
Q_{GD}	gate-drain charge	$I_D = 25 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V};$ see Figure 14 ; see Figure 13	-	17	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 50 \text{ V};$ see Figure 14 ; see Figure 13	-	4.4	-	V
C_{iss}	input capacitance	$V_{DS} = 50 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ °C};$ see Figure 15	-	3195	-	pF
C_{oss}	output capacitance		-	221	-	pF
C_{rss}	reverse transfer capacitance		-	136	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 50 \text{ V}; R_L = 2 \text{ Ω}; V_{GS} = 10 \text{ V};$ $R_{G(ext)} = 4.7 \text{ Ω}; T_j = 25 \text{ °C}$	-	20.7	-	ns
t_r	rise time		-	25	-	ns
$t_{d(off)}$	turn-off delay time		-	52.5	-	ns
t_f	fall time		-	24	-	ns

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 15\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ °C}$; see Figure 16	-	0.8	1.2	V
t_{rr}	reverse recovery time	$I_S = 25\text{ A}$; $di_S/dt = 100\text{ A}/\mu\text{s}$;	-	52	-	ns
Q_r	recovered charge	$V_{GS} = 0\text{ V}$; $V_{DS} = 50\text{ V}$	-	109	-	nC

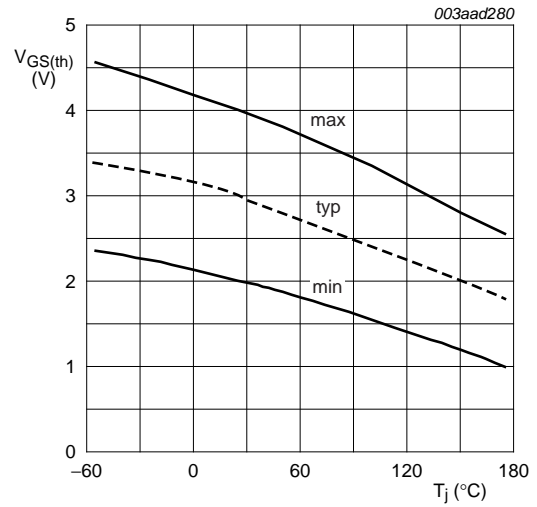
[1] Measured 3 mm from package.





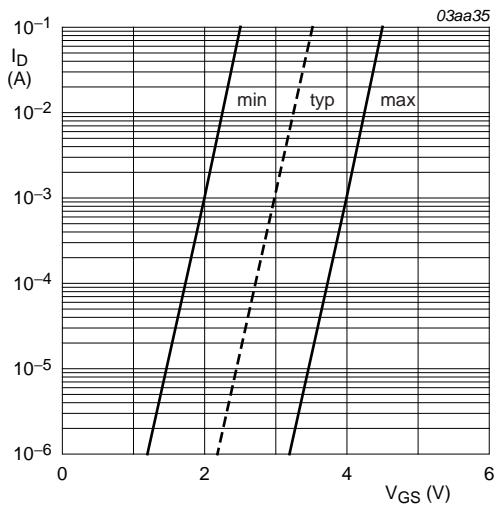
$$V_{DS} > I_D \times R_{DS(on)}$$

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



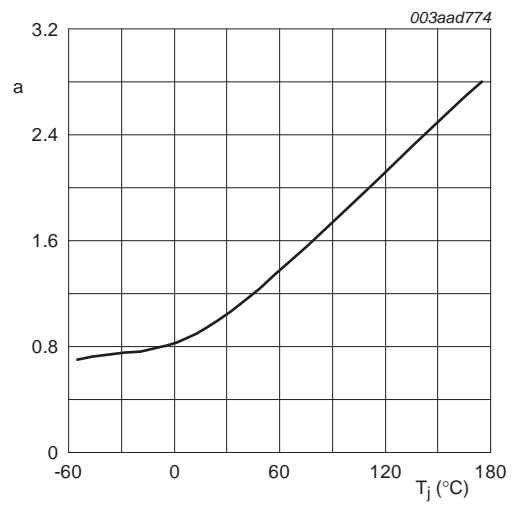
$$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$$

Fig 9. Gate-source threshold voltage as a function of junction temperature



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

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



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

Fig 11. Normalized drain-source on-state resistance factor as a function of junction temperature

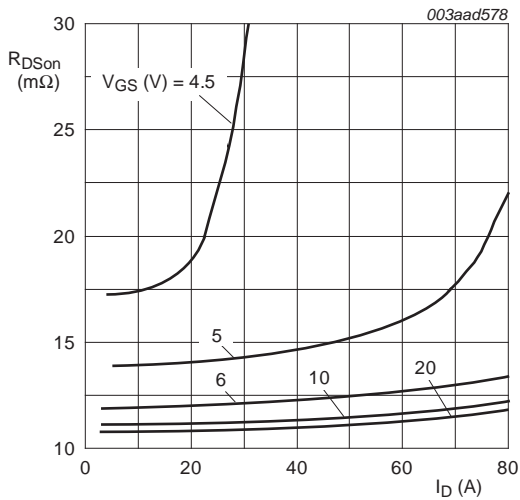


Fig 12. Drain-source on-state resistance as a function of drain current; typical values

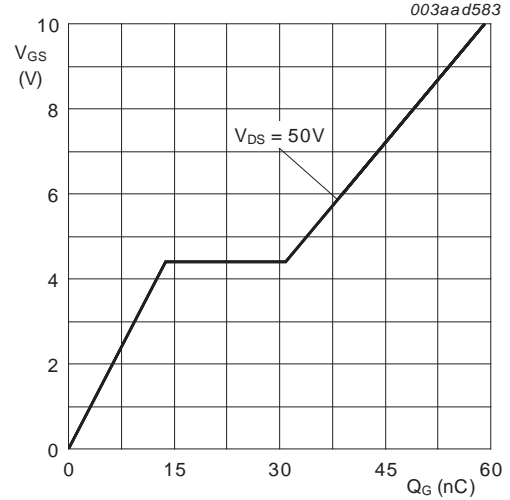


Fig 13. Gate-source voltage as a function of gate charge; typical values

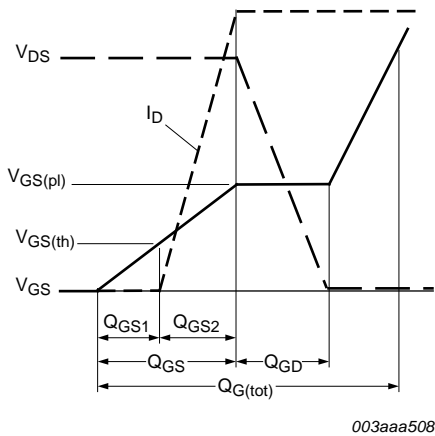


Fig 14. Gate charge waveform definitions

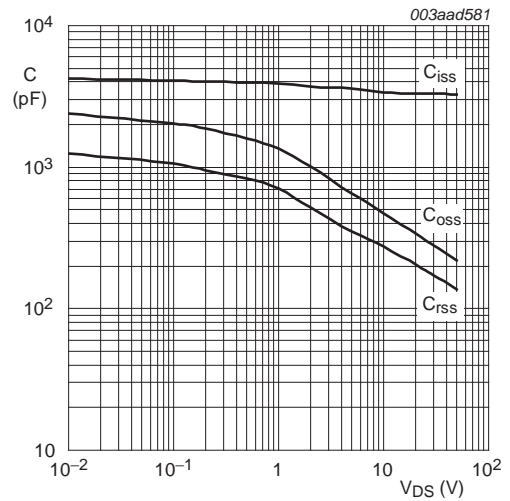


Fig 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

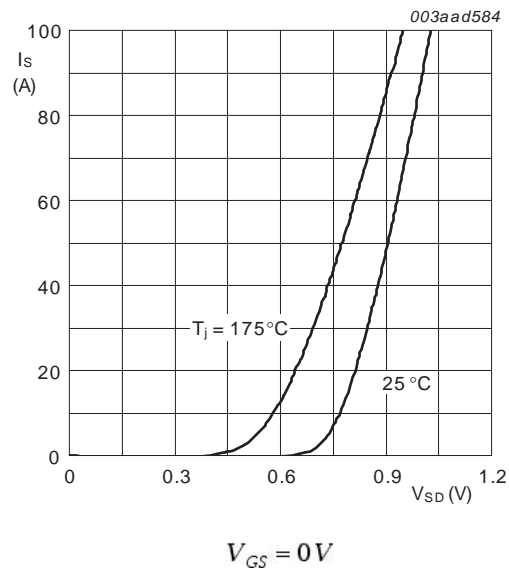


Fig 16. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

7. Package outline

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

SOT226

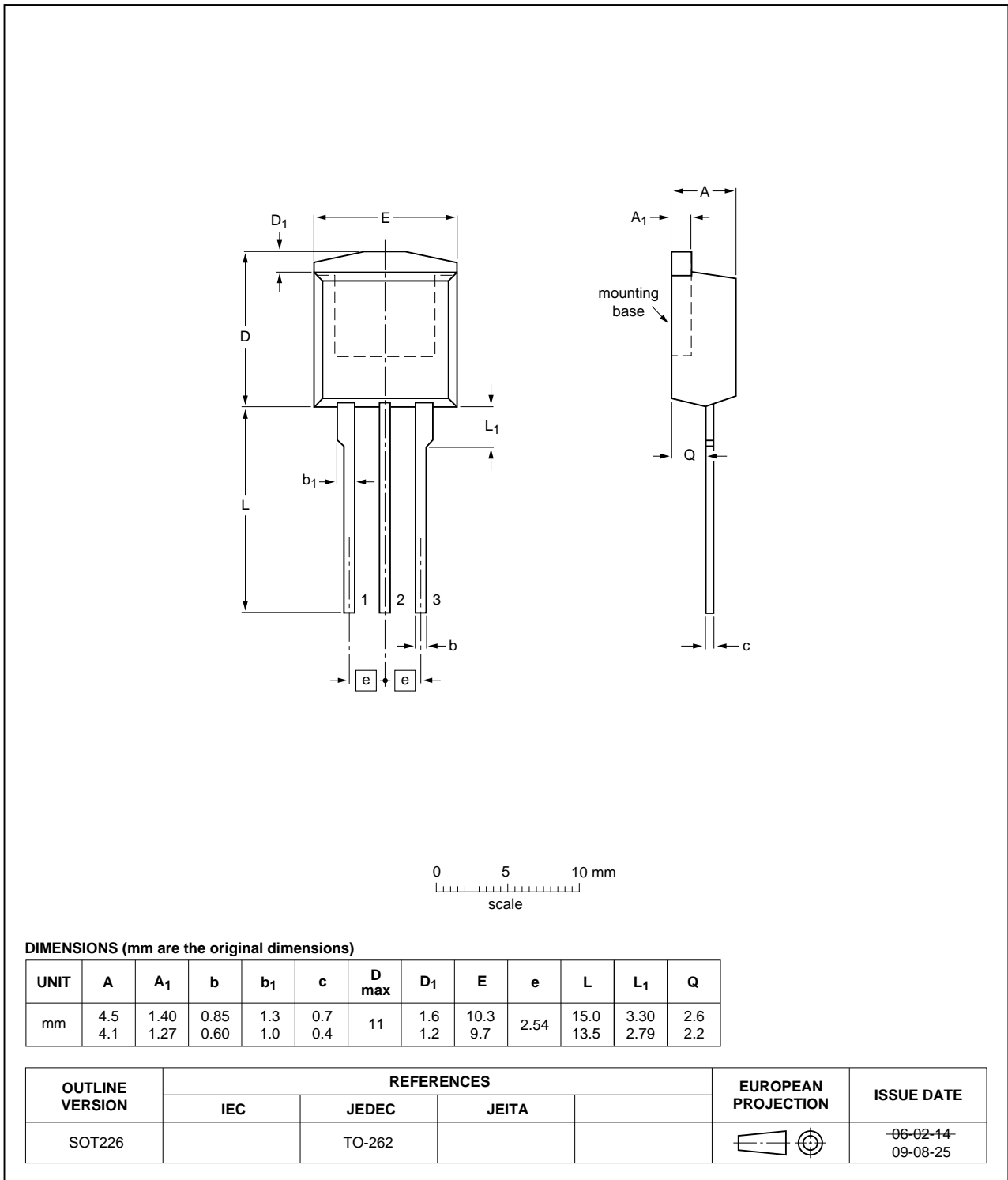


Fig 17. Package outline SOT226 (I2PAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN013-100ES v.3	20110929	Product data sheet	-	PSMN013-100ES v.2
Modifications:	<ul style="list-style-type: none">• Status changed from objective to product.• Various changes to content.			
PSMN013-100ES v.2	20100219	Objective data sheet	-	PSMN013-100ES v.1

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.

[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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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