

1. Product profile

1.1 General description

Standard level N-channel enhancement 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

- 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

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	-	-	68	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	-	170	W
T_j	junction temperature		-55	-	175	°C
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(init)} = 25\text{ °C}$; $I_D = 68\text{ A}$; $V_{sup} \leq 100\text{ V}$; unclamped; $R_{GS} = 50\text{ }\Omega$	-	-	127	mJ
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 and 13	-	17	-	nC
$Q_{G(tot)}$	total gate charge	$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $V_{DS} = 50\text{ V}$; see Figure 13 and 14	-	59	-	nC

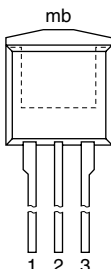
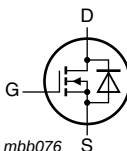


Table 1. Quick reference ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 15 A; T _j = 100 °C; see Figure 11	-	-	25	mΩ
		V _{GS} = 10 V; I _D = 15 A; T _j = 25 °C; see Figure 12 and 11	-	11	13.9	mΩ

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	-	47	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 1	-	68	A
I_{DM}	peak drain current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$	-	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
$T_{sld(M)}$	peak soldering temperature		-	260	°C

Source-drain diode

I_S	source current	$T_{mb} = 25\text{ °C}$	-	68	A
I_{SM}	peak source current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$	-	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
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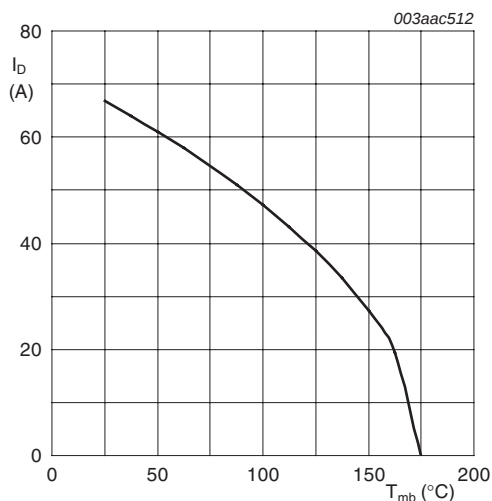


Fig 1. Continuous drain current as a function of mounting base temperature

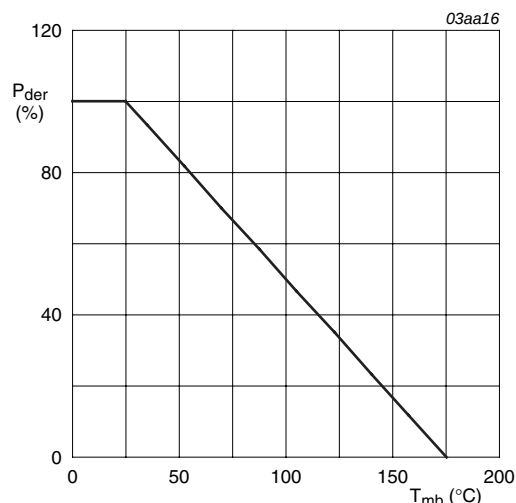


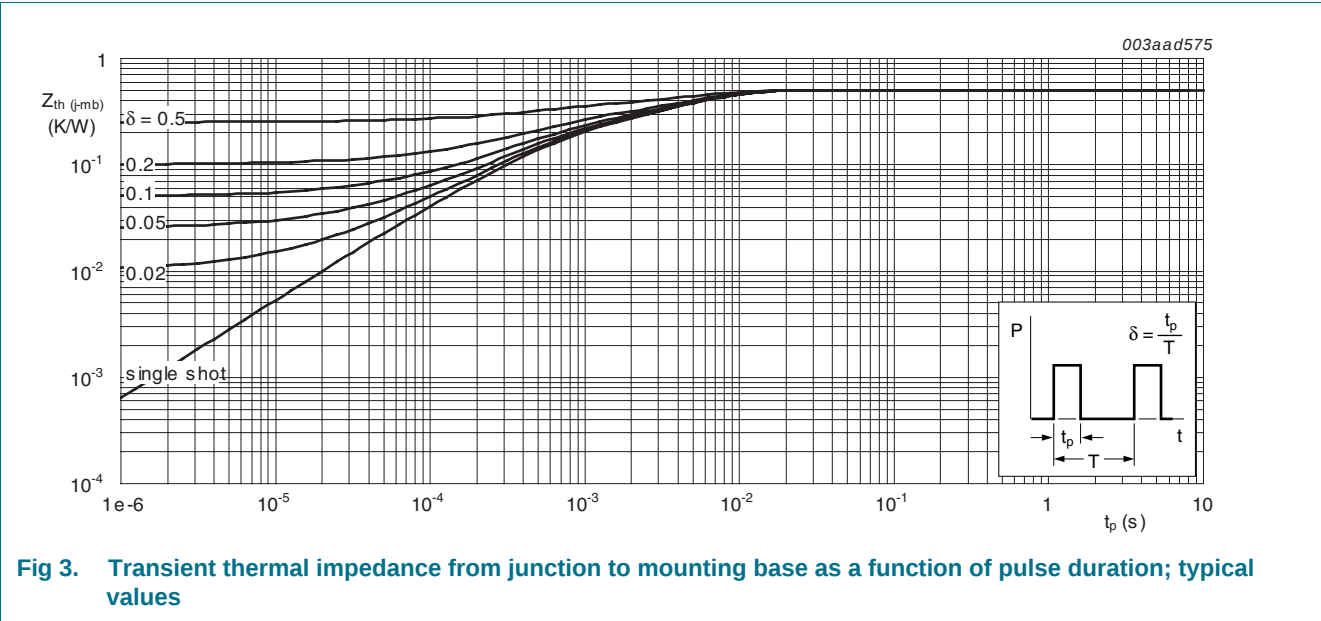
Fig 2. Normalized total power dissipation as a function of mounting base temperature

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

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	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^{\circ}\text{C}$	90	-	-	V
		$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^{\circ}\text{C}$	100	-	-	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 Figure 9	1	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^{\circ}\text{C};$ see Figure 10 and 9	2	3	4	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^{\circ}\text{C};$ see Figure 10	-	-	4.8	V
I_{DSS}	drain leakage current	$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^{\circ}\text{C}$	-	-	100	μA
		$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^{\circ}\text{C}$	-	0.06	2	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^{\circ}\text{C}$	-	10	100	nA
		$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^{\circ}\text{C}$	-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 175 \text{ }^{\circ}\text{C};$ see Figure 11	-	30	38.9	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 100 \text{ }^{\circ}\text{C};$ see Figure 11	-	-	25	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ }^{\circ}\text{C};$ see Figure 12 and 11	-	11	13.9	mΩ
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 and 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 and 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 and 13	-	17	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 50 \text{ V};$ see Figure 14 and 13	-	4.4	-	V
C_{iss}	input capacitance	$V_{DS} = 50 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$	-	3195	-	pF
C_{oss}	output capacitance	$T_j = 25 \text{ }^{\circ}\text{C};$ see Figure 15	-	221	-	pF
C_{rss}	reverse transfer capacitance		-	136	-	pF

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t _{d(on)}	turn-on delay time	V _{DS} = 50 V; R _L = 2 Ω; V _{GS} = 10 V; R _{G(ext)} = 4.7 Ω; T _j = 25 °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
Source-drain diode						
V _{SD}	source-drain voltage	I _S = 15 A; V _{GS} = 0 V; T _j = 25 °C; see Figure 16	-	0.8	1.2	V
t _{rr}	reverse recovery time	I _S = 25 A; dI _S /dt = 100 A/μs; V _{GS} = 0 V;	-	52	-	ns
Q _r	recovered charge	V _{DS} = 50 V	-	109	-	nC

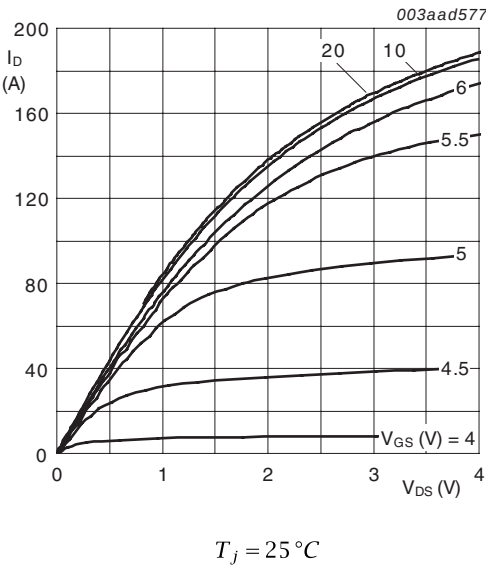


Fig 4. Output characteristics: drain current as a function of drain-source voltage; typical values

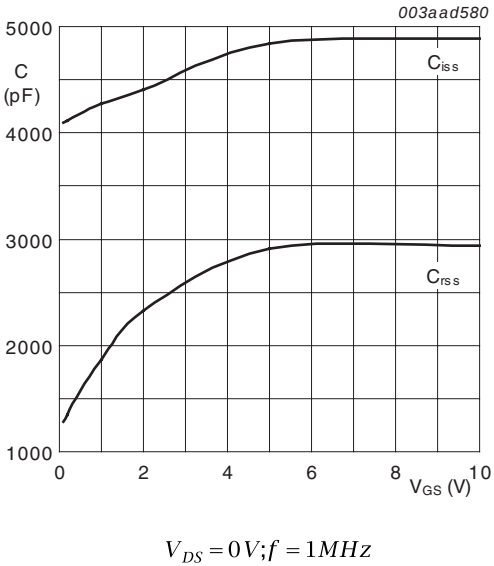
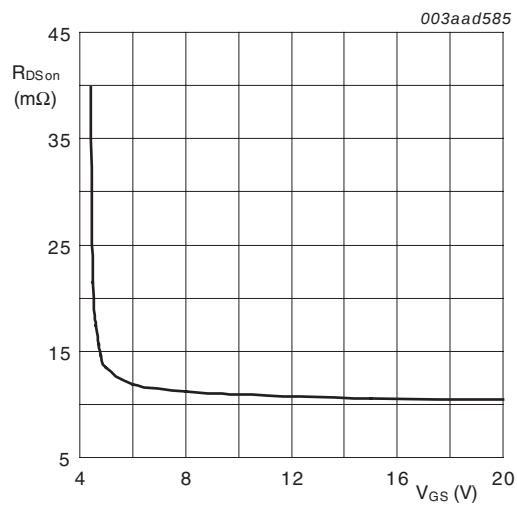
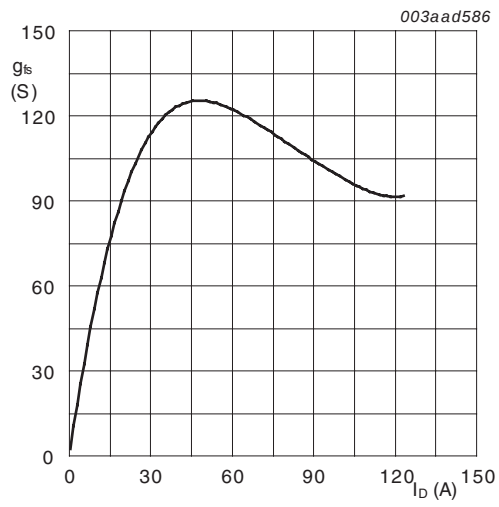


Fig 5. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



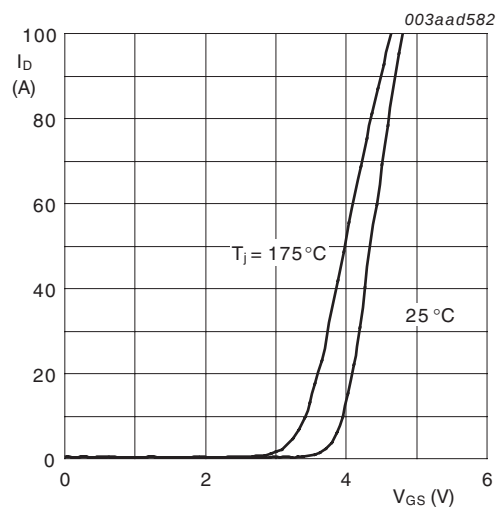
$T_j = 25\text{ }^{\circ}\text{C}$

Fig 6. Drain-source on-state resistance as a function of gate-source voltage; typical values



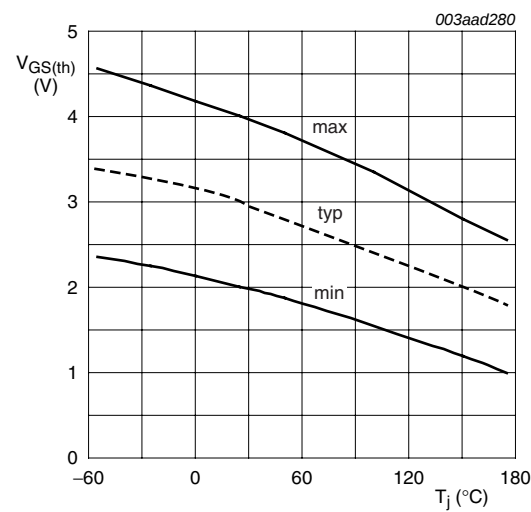
$T_j = 25\text{ }^{\circ}\text{C}; V_{DS} = 15\text{ V}$

Fig 7. Forward transconductance as a function of drain current; typical values



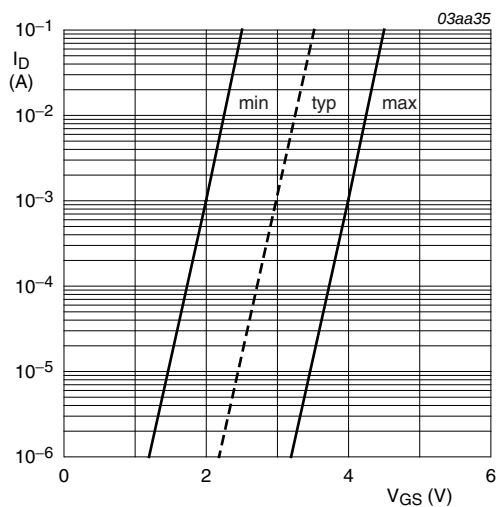
$V_{DS} > I_D \times R_{DS(on)}$

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



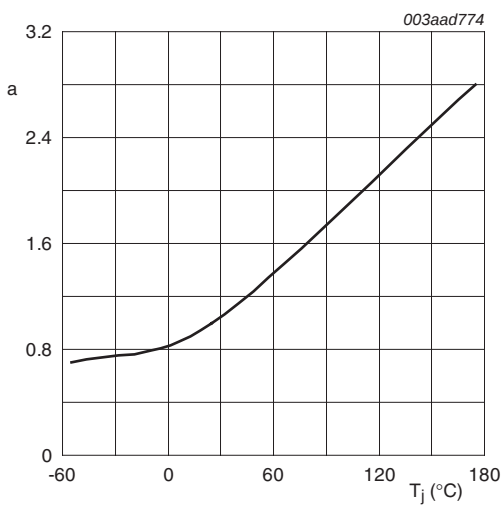
$I_D = 1\text{ mA}; V_{DS} = V_{GS}$

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



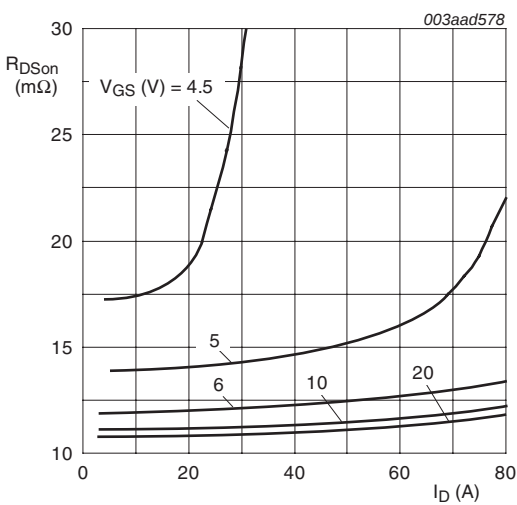
$T_j = 25\text{ }^{\circ}\text{C}; V_{DS} = 5\text{ V}$

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



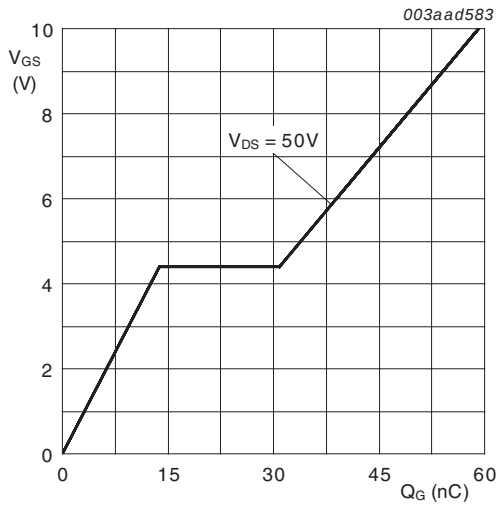
$$a = \frac{R_{DSon}}{R_{DSon(25\text{ }^{\circ}\text{C})}}$$

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



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

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



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

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

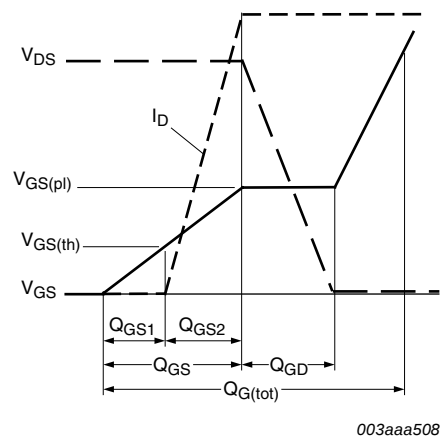


Fig 14. Gate charge waveform definitions

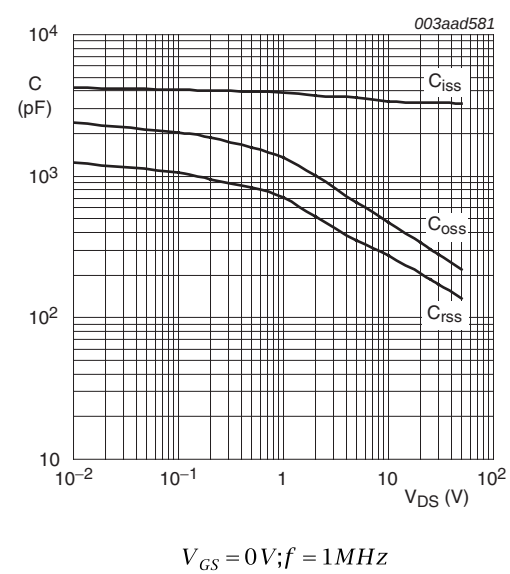


Fig 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

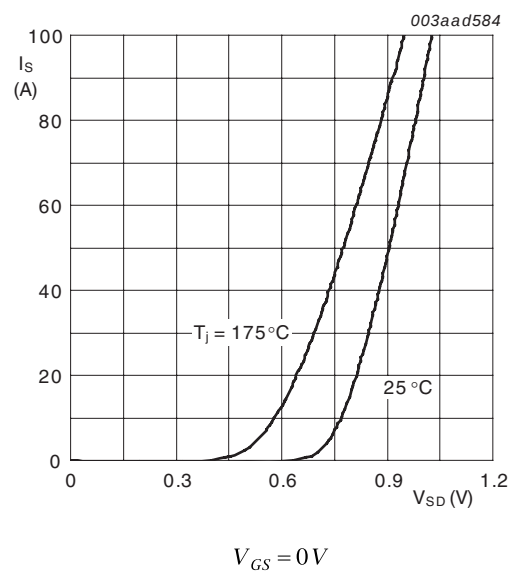


Fig 16. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

7. Package outline

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

SOT226

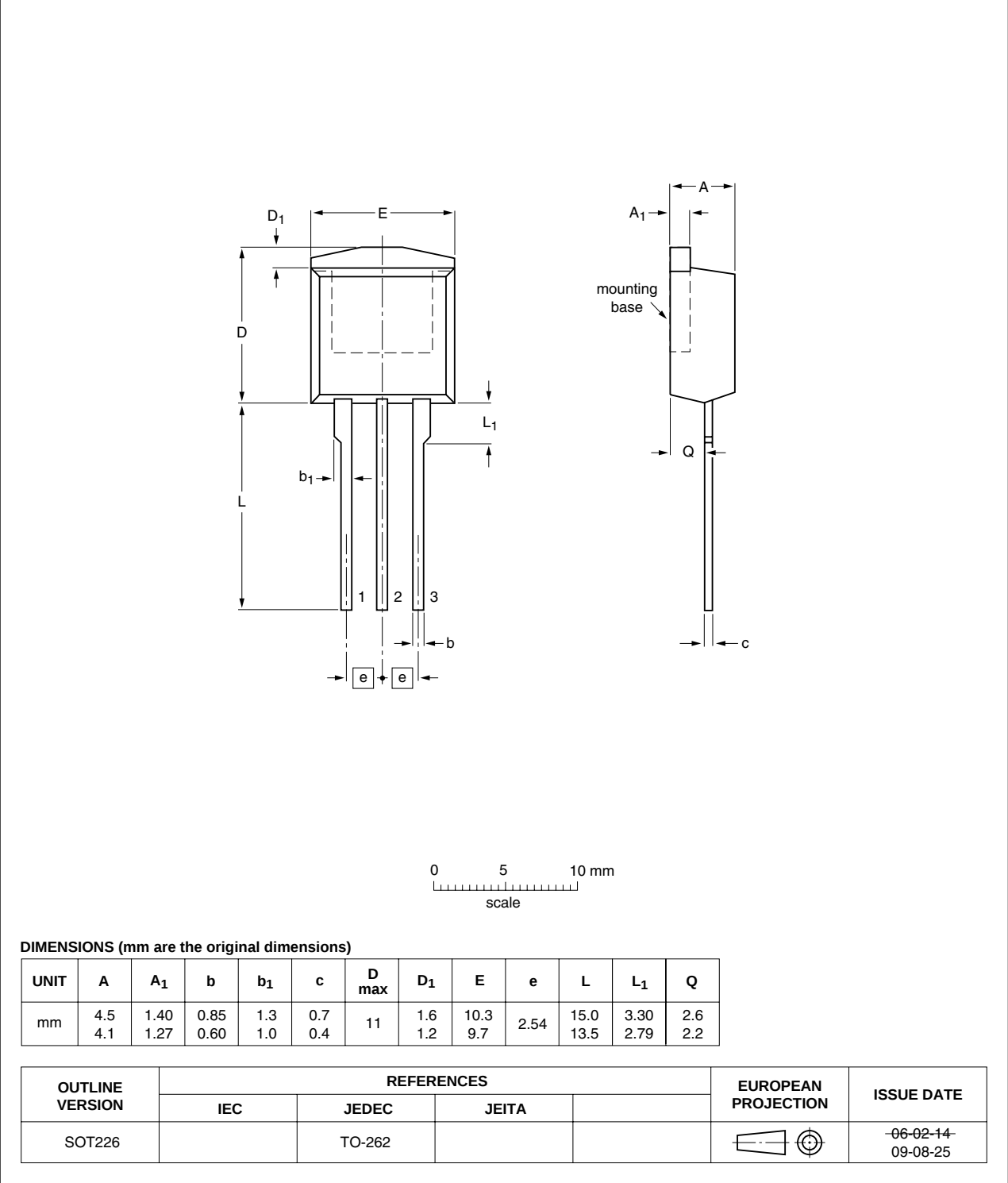


Fig 17. Package outline SOT226 (I2PAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN013-100ES_2	20100219	Objective data sheet	-	PSMN013-100ES_1
Modifications:	• Various changes to content.			
PSMN013-100ES_1	20090917	Objective data sheet	-	-

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".

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