



PSMN1R1-30EL

N-channel 30 V 1.3 mΩ logic level MOSFET in I2PAK

2 April 2014

Product data sheet

1. General description

Logic 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.

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 ≥ 25 °C; T _j ≤ 175 °C		-	-	30	V
I _D	drain current	T _{mb} = 25 °C; V _{GS} = 10 V; Fig. 2	[1]	-	-	120	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 1		-	-	338	W
T _j	junction temperature			-55	-	175	°C
Static characteristics							
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 25 A; T _j = 25 °C; Fig. 12	[2]	-	1.1	1.3	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 100 °C; Fig. 13		-	1.5	1.8	mΩ
Dynamic characteristics							
Q _{GD}	gate-drain charge	V _{GS} = 4.5 V; I _D = 75 A; V _{DS} = 15 V; Fig. 14 ; Fig. 15		-	37	-	nC
Q _{G(tot)}	total gate charge			-	118	-	nC

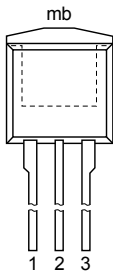
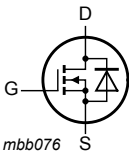
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 120\text{ A}$; $V_{sup} \leq 30\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped	-	-	1.9	J

[1] Continuous current is limited by package.

[2] Measured 3 mm from package.

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p>I2PAK (SOT226)</p>	
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN1R1-30EL	I2PAK	plastic single-ended package (I2PAK); TO-262	SOT226

7. Marking

Table 4. Marking codes

Type number	Marking code
PSMN1R1-30EL	PSMN1R1-30EL

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 _{GS}	gate-source voltage			-20	20	V
P _{tot}	total power dissipation	T _{mb} = 25 °C; Fig. 1		-	338	W
I _D	drain current	V _{GS} = 10 V; T _{mb} = 100 °C; Fig. 2	[1]	-	120	A
		V _{GS} = 10 V; T _{mb} = 25 °C; Fig. 2	[1]	-	120	A
I _{DM}	peak drain current	pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C; Fig. 3		-	1609	A
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 °C	[1]	-	120	A
I _{SM}	peak source current	pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C		-	1609	A
Avalanche ruggedness						
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	V _{GS} = 10 V; T _{j(init)} = 25 °C; I _D = 120 A; V _{sup} ≤ 30 V; R _{GS} = 50 Ω; unclamped		-	1.9	J

[1] Continuous current is limited by package.

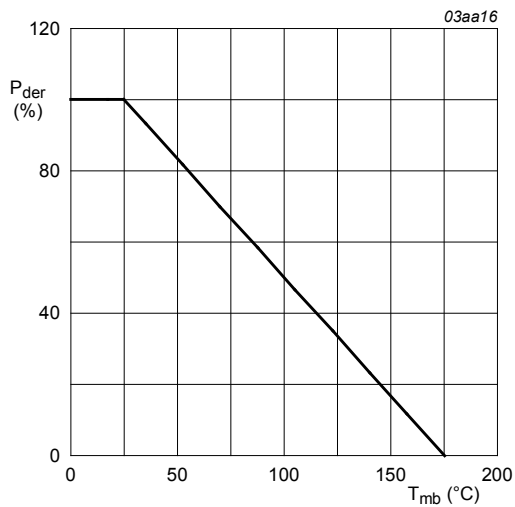


Fig. 1. Normalized total power dissipation as a function of mounting base temperature

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

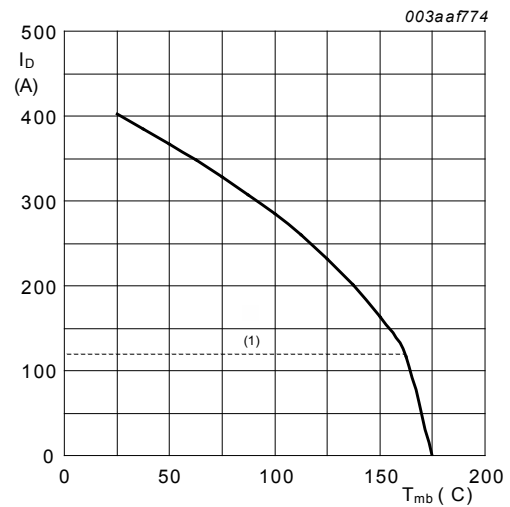


Fig. 2. Continuous drain current as a function of mounting base temperature.

V_{GS} ≥ 10 V; (1) Capped at 120 A due to package

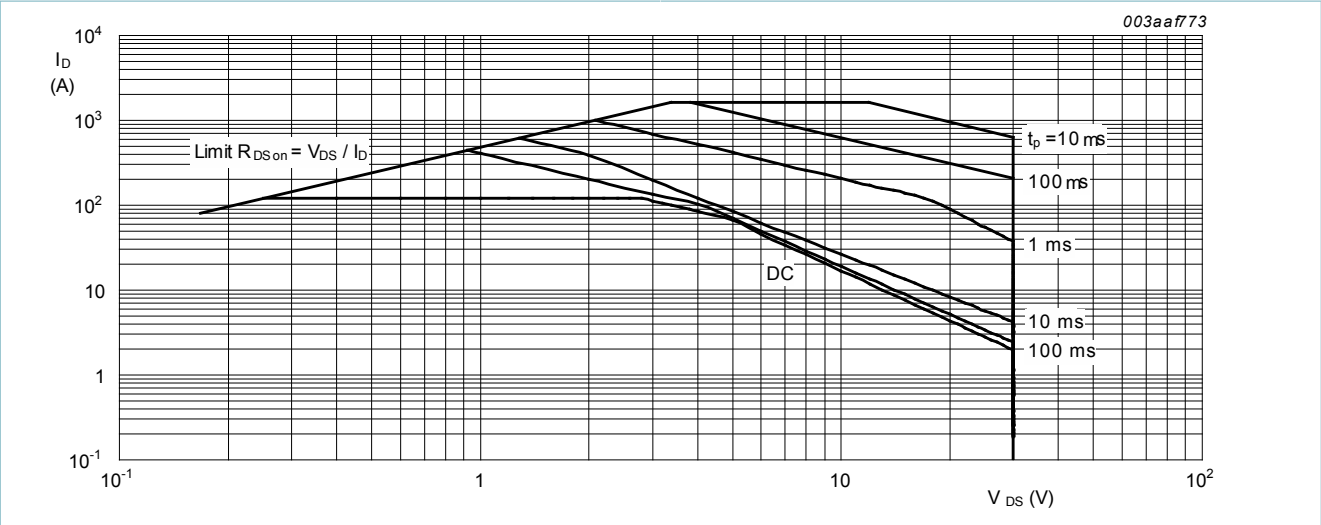


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25\text{ }^{\circ}\text{C}$; 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	0.44	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	Vertical in free air	-	60	-	K/W

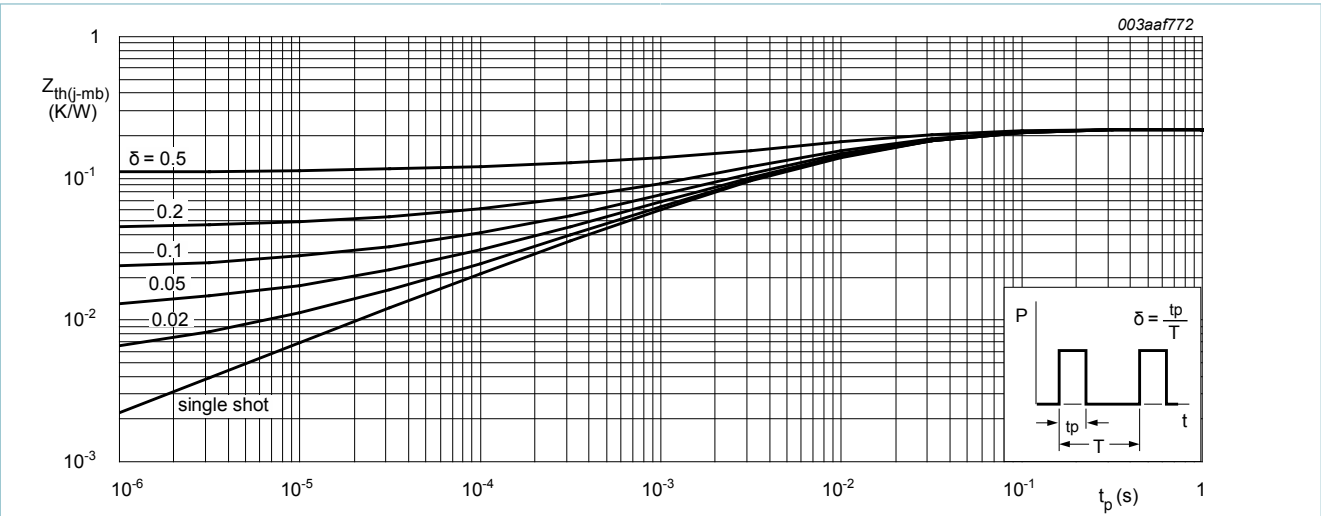


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

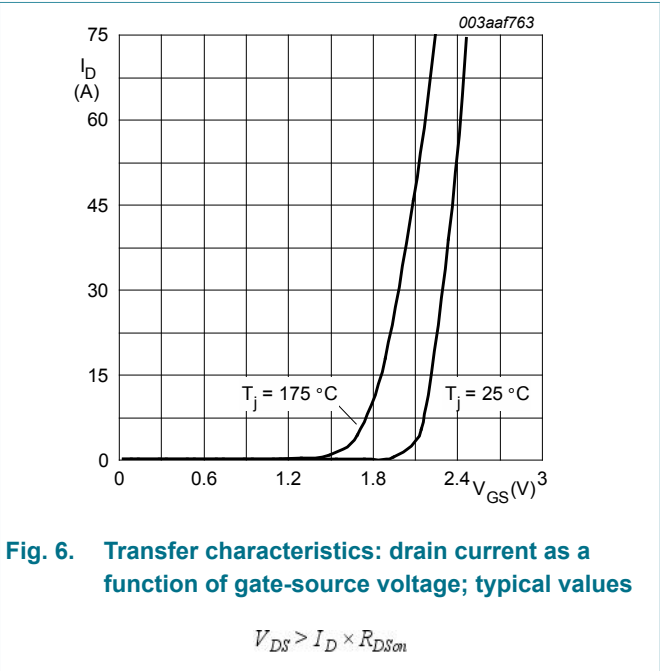
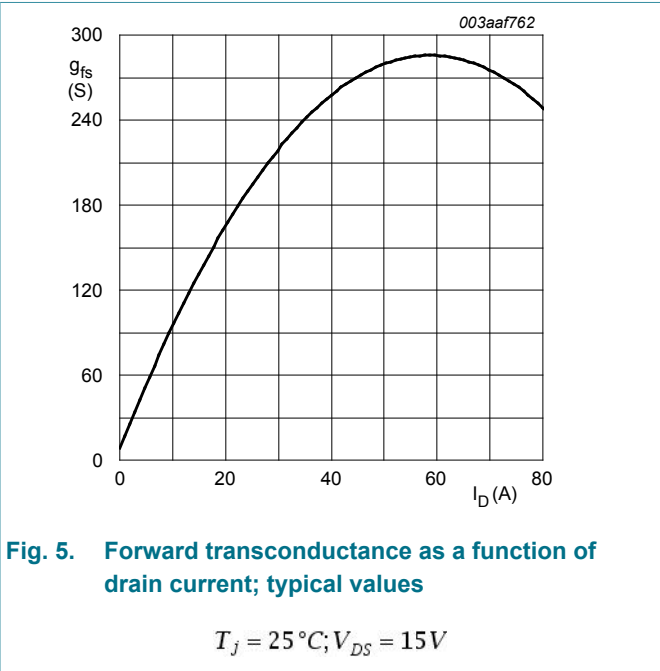
10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu A$; $V_{GS} = 0\ V$; $T_J = 25\ ^\circ C$		30	-	-	V
		$I_D = 250\ \mu A$; $V_{GS} = 0\ V$; $T_J = -55\ ^\circ C$		27	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ mA$; $V_{DS} = V_{GS}$; $T_J = 25\ ^\circ C$; Fig. 10 ; Fig. 11		1.3	1.7	2.15	V
		$I_D = 2\ mA$; $V_{DS} = V_{GS}$; $T_J = 175\ ^\circ C$; Fig. 11		0.5	-	-	V
		$I_D = 1\ mA$; $V_{DS} = V_{GS}$; $T_J = -55\ ^\circ C$; Fig. 11		-	-	2.5	V
I_{DSS}	drain leakage current	$V_{DS} = 30\ V$; $V_{GS} = 0\ V$; $T_J = 25\ ^\circ C$		-	0.02	10	μA
		$V_{DS} = 30\ V$; $V_{GS} = 0\ V$; $T_J = 175\ ^\circ C$		-	250	500	μA
I_{GSS}	gate leakage current	$V_{GS} = 16\ V$; $V_{DS} = 0\ V$; $T_J = 25\ ^\circ C$		-	10	100	nA
		$V_{GS} = -16\ V$; $V_{DS} = 0\ V$; $T_J = 25\ ^\circ C$		-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\ V$; $I_D = 25\ A$; $T_J = 25\ ^\circ C$; Fig. 12	[1]	-	1.1	1.3	mΩ
		$V_{GS} = 4.5\ V$; $I_D = 25\ A$; $T_J = 25\ ^\circ C$; Fig. 12		-	1.2	1.6	mΩ
		$V_{GS} = 10\ V$; $I_D = 25\ A$; $T_J = 175\ ^\circ C$; Fig. 13 ; Fig. 12		-	2.1	2.5	mΩ
		$V_{GS} = 10\ V$; $I_D = 25\ A$; $T_J = 100\ ^\circ C$; Fig. 13		-	1.5	1.8	mΩ
R_G	gate resistance	$f = 1\ MHz$		-	1.1	-	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	$I_D = 75\ A$; $V_{DS} = 15\ V$; $V_{GS} = 10\ V$; Fig. 14 ; Fig. 15		-	243	-	nC
		$I_D = 0\ A$; $V_{DS} = 0\ V$; $V_{GS} = 10\ V$; Fig. 14 ; Fig. 15		-	222	-	nC
		$I_D = 75\ A$; $V_{DS} = 15\ V$; $V_{GS} = 4.5\ V$; Fig. 14 ; Fig. 15		-	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	$V_{DS} = 15\ V$; Fig. 14 ; Fig. 15		-	2.8	-	V

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
C _{iss}	input capacitance	V _{DS} = 15 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C; Fig. 16		-	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 V; R _L = 0.2 Ω; V _{GS} = 4.5 V; R _{G(ext)} = 5 Ω; I _D = 75 A; T _j = 25 °C		-	95	-	ns
t _r	rise time			-	213	-	ns
t _{d(off)}	turn-off delay time			-	199	-	ns
t _f	fall time			-	115	-	ns
Source-drain diode							
V _{SD}	source-drain voltage	I _S = 25 A; V _{GS} = 0 V; T _j = 25 °C; Fig. 17		-	0.8	1.2	V
t _{rr}	reverse recovery time	I _S = 25 A; dI _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 15 V		-	67	-	ns
Q _r	recovered charge			-	123	-	nC

[1] Measured 3 mm from package.



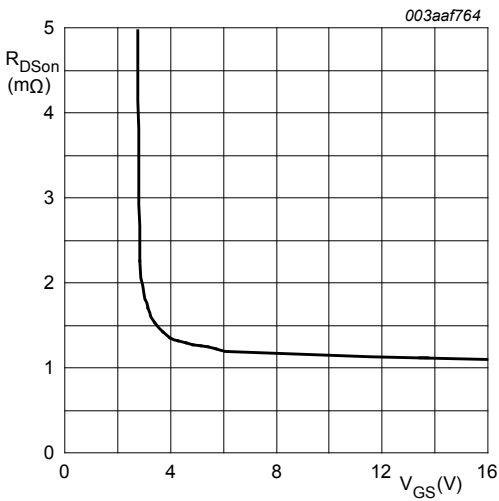


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

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

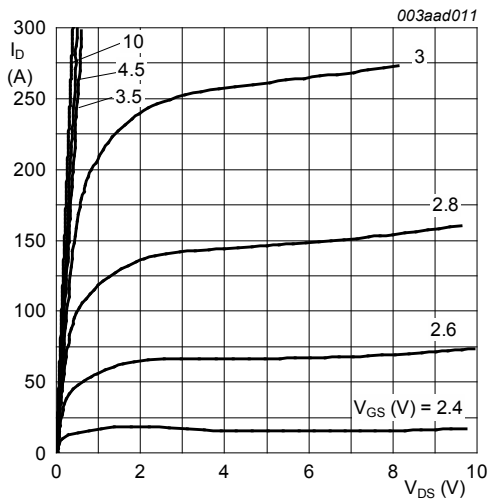


Fig. 8. Output characteristics: drain current as a function of drain-source voltage; typical values

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

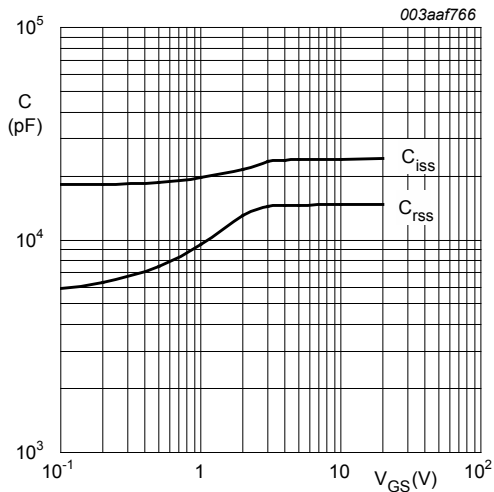


Fig. 9. Input and reverse transfer capacitances as a function of gate-source voltage; typical values

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

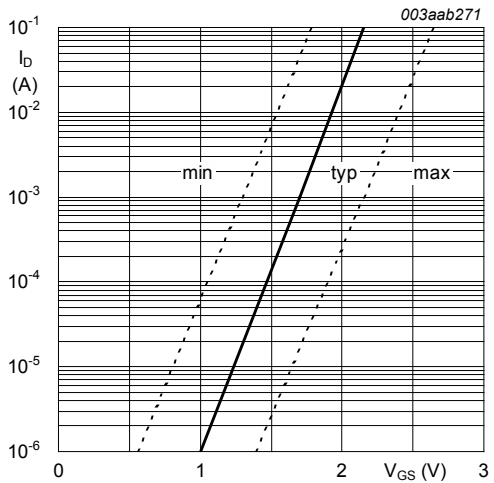


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

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

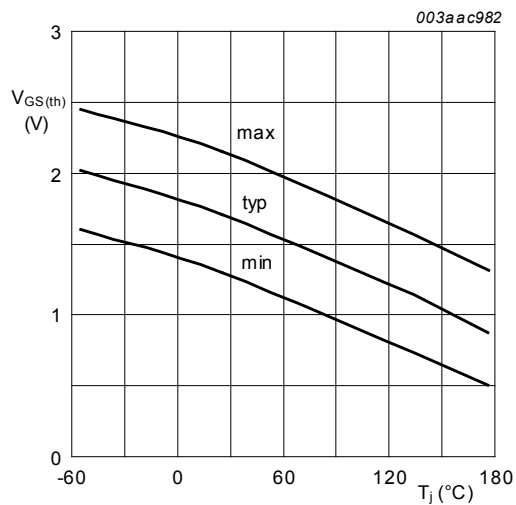


Fig. 11. Gate-source threshold voltage as a function of junction temperature

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

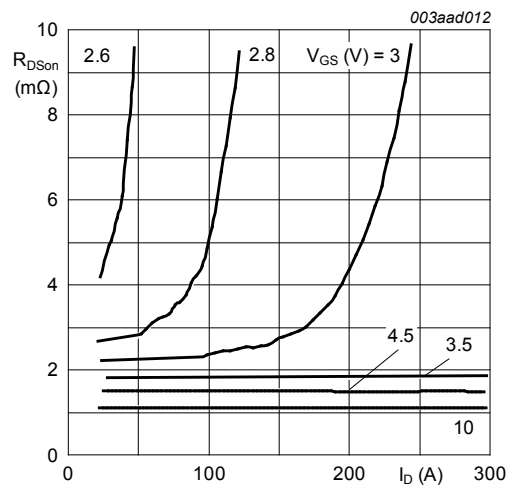


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

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

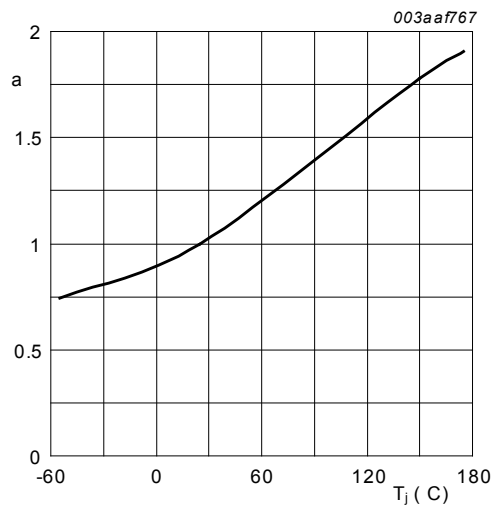


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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

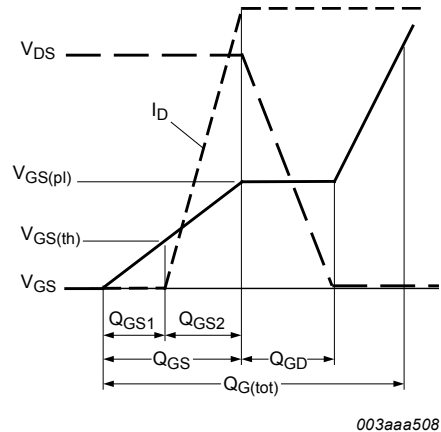


Fig. 14. Gate charge waveform definitions

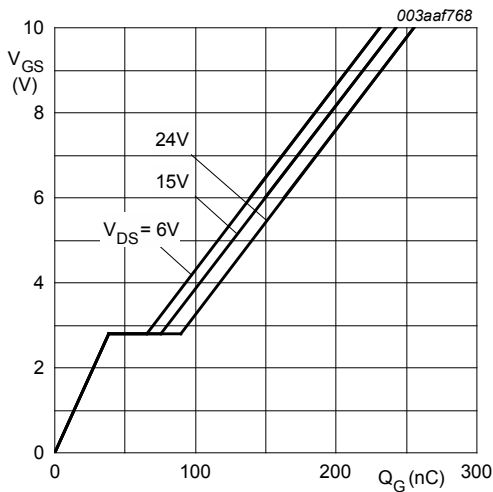


Fig. 15. Gate-source voltage as a function of gate charge; typical values

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

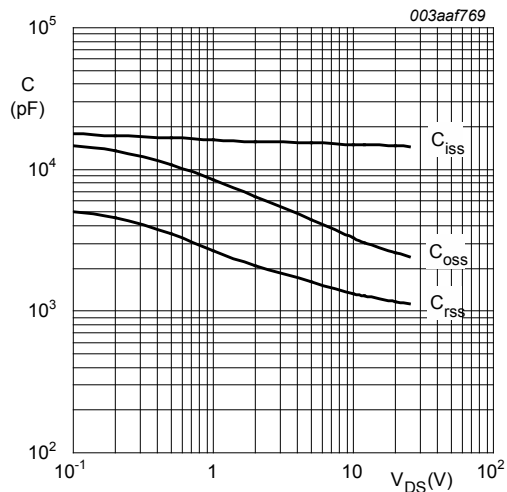


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

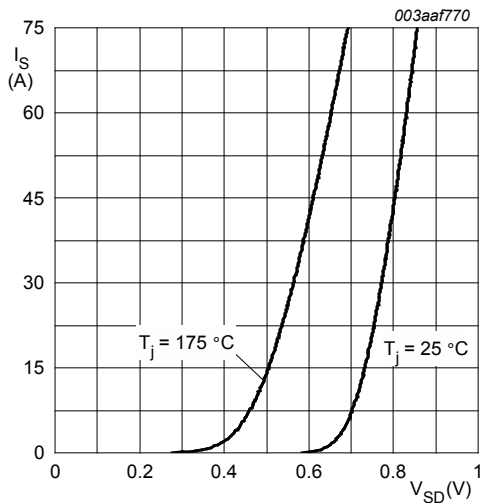


Fig. 17. Source current as a function of source-drain voltage; typical values

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

11. Package outline

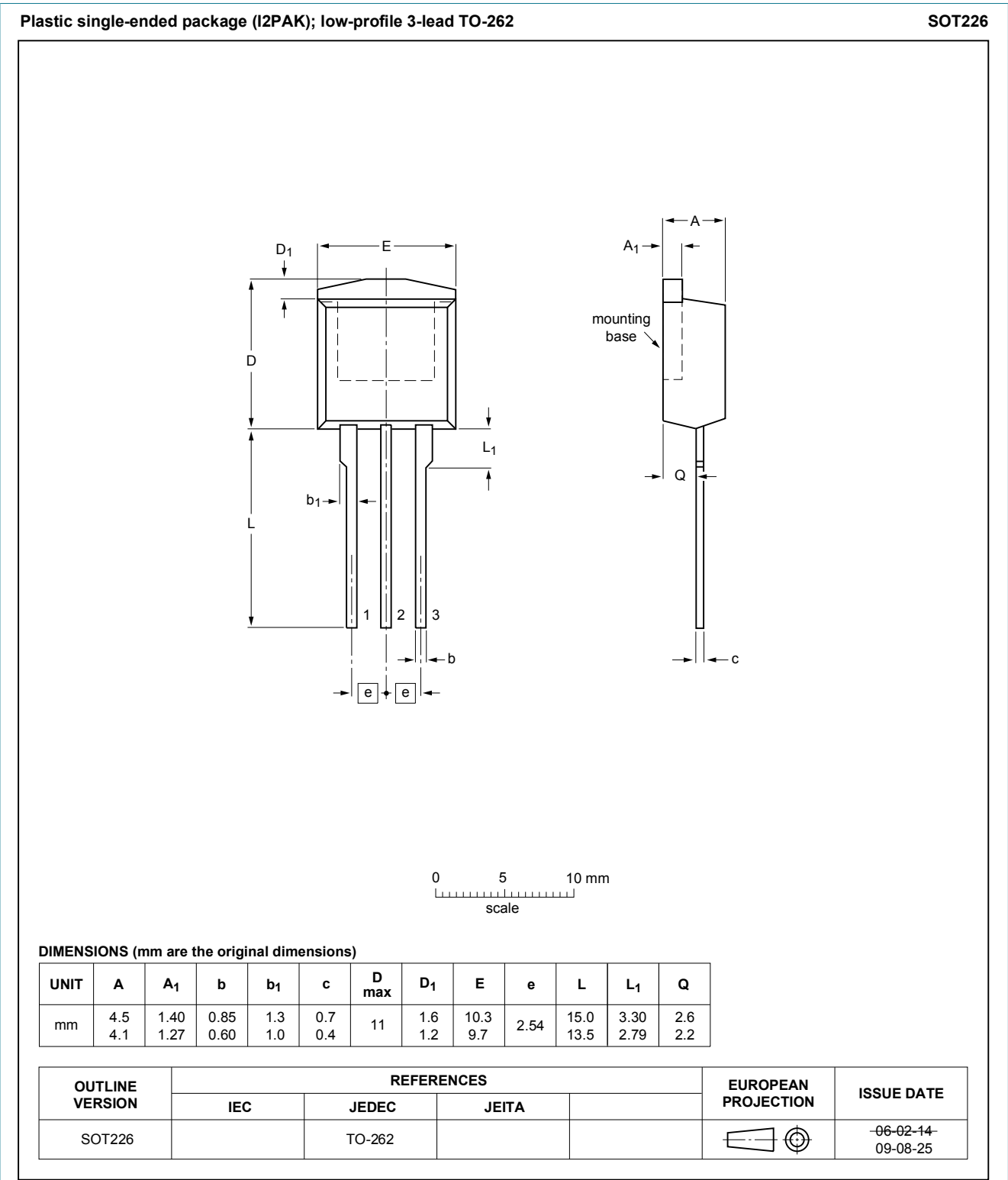


Fig. 18. Package outline I2PAK (SOT226)

12. Legal information

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.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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