



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	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$		-	-	30	V
I_D	drain current	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ Fig. 2	[1]	-	-	120	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C};$ Fig. 1		-	-	338	W
T_j	junction temperature			-55	-	175	°C
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ °C};$ Fig. 12	[2]	-	1.1	1.3	mΩ
		$V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 100\text{ °C};$ Fig. 13		-	1.5	1.8	mΩ
Dynamic characteristics							
Q_{GD}	gate-drain charge	$V_{GS} = 4.5\text{ V}; I_D = 75\text{ A}; V_{DS} = 15\text{ V};$ Fig. 14; Fig. 15		-	37	-	nC
$Q_{G(tot)}$	total gate charge			-	118	-	nC

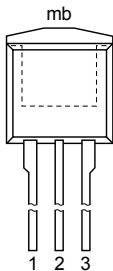
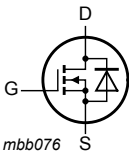
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 120\text{ A}$; $V_{\text{sup}} \leq 30\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped	-	-	1.9	J

[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 style="text-align: center;">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

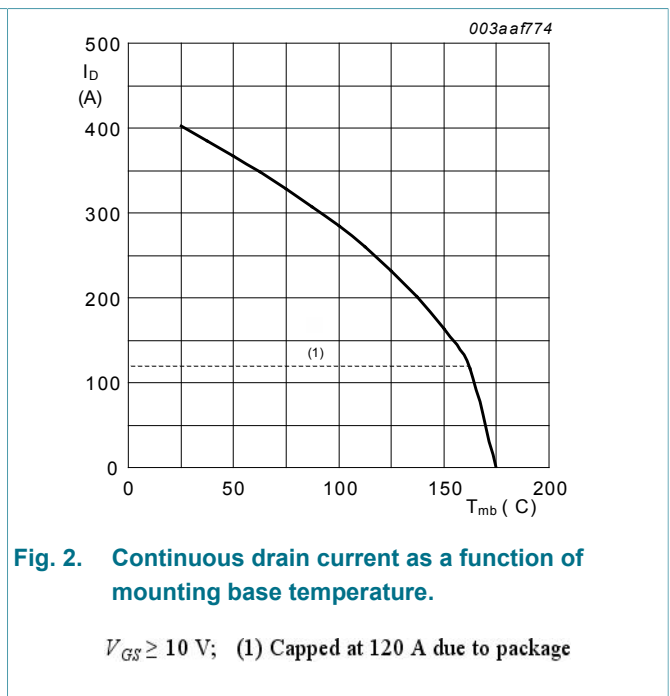
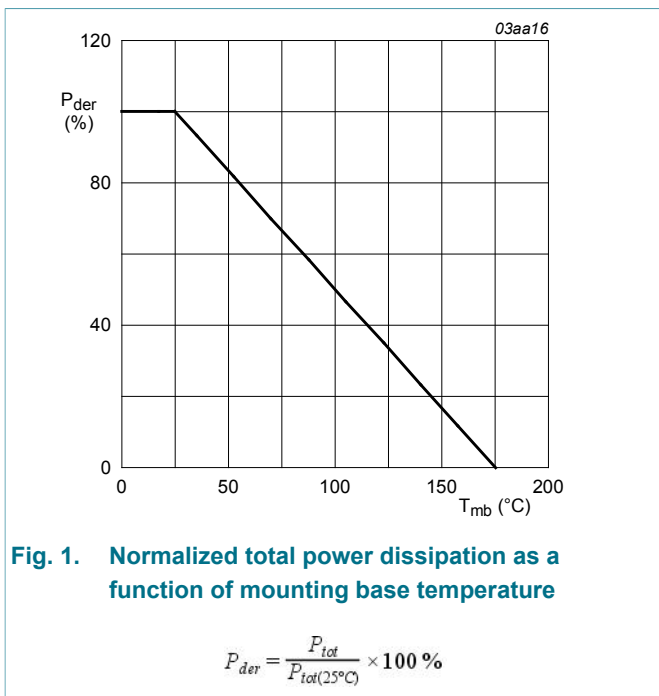
Table 5. Limiting values

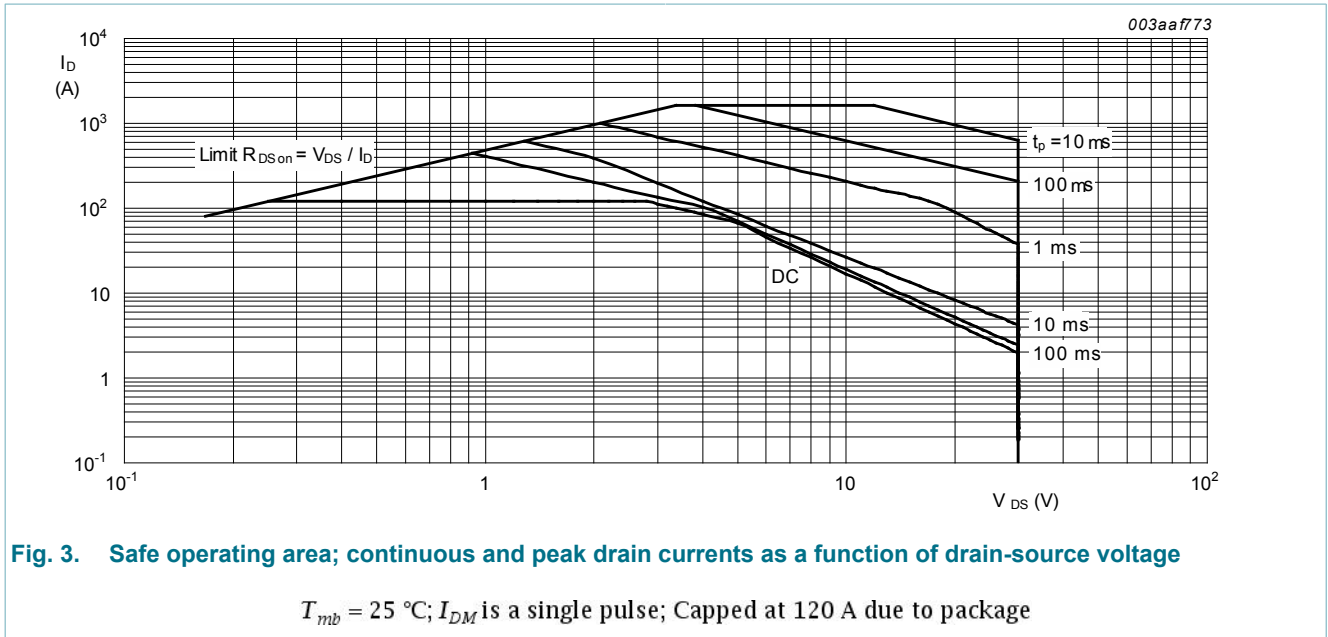
In accordance with the Absolute Maximum Rating System (IEC 60134).

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 _{slid(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.

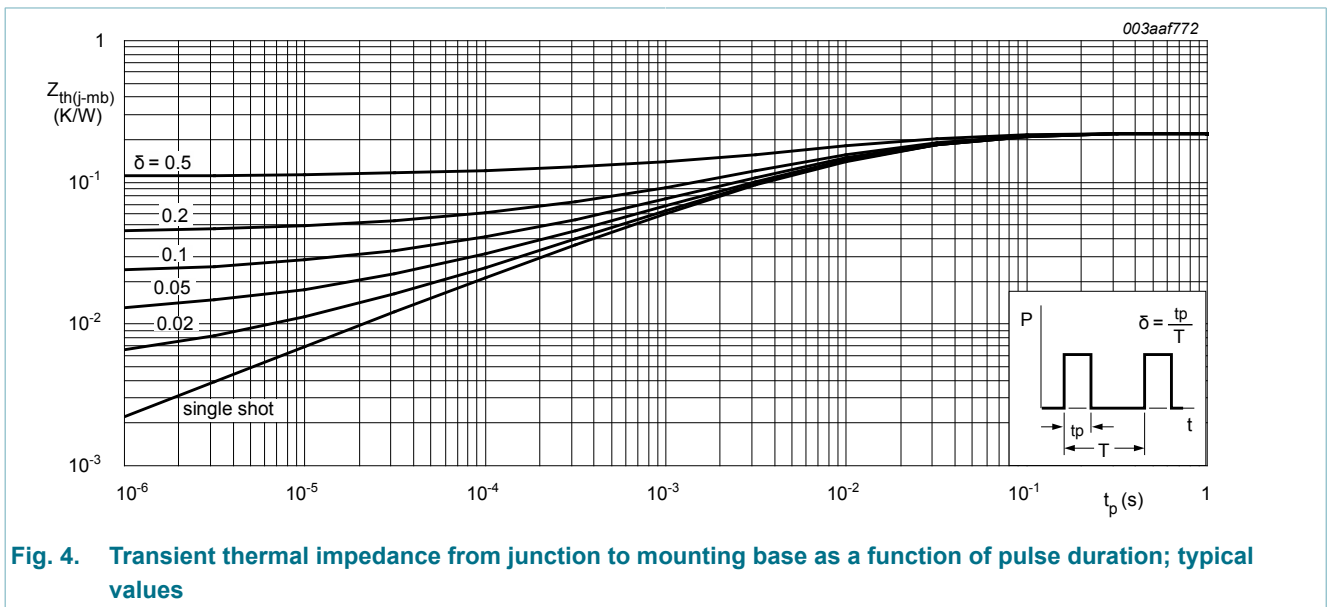




9. Thermal characteristics

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



10. Characteristics

Table 7. Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{iss}	input capacitance	$V_{DS} = 15\text{ V}; V_{GS} = 0\text{ V}; f = 1\text{ MHz};$	-	14850	-	pF
C_{oss}	output capacitance	$T_j = 25\text{ °C};$ Fig. 16	-	2799	-	pF
C_{rss}	reverse transfer capacitance		-	1215	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 15\text{ V}; R_L = 0.2\text{ }Ω; V_{GS} = 4.5\text{ V};$	-	95	-	ns
t_r	rise time	$R_{G(ext)} = 5\text{ }Ω; I_D = 75\text{ A}; T_j = 25\text{ °C}$	-	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	$I_S = 25\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ °C};$ Fig. 17	-	0.8	1.2	V
t_{rr}	reverse recovery time	$I_S = 25\text{ A}; di_S/dt = -100\text{ A}/μs; V_{GS} = 0\text{ V};$	-	67	-	ns
Q_r	recovered charge	$V_{DS} = 15\text{ V}$	-	123	-	nC

[1] Measured 3 mm from package.

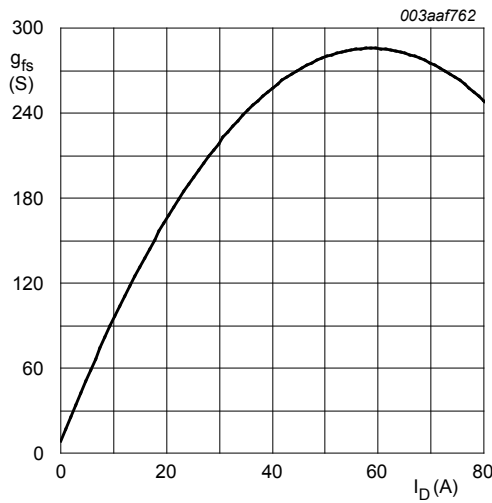


Fig. 5. Forward transconductance as a function of drain current; typical values

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

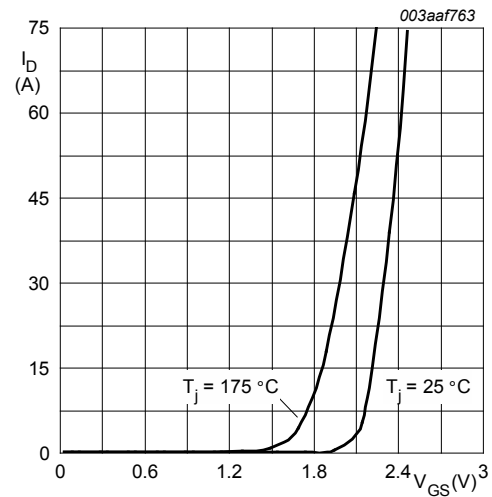


Fig. 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values

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

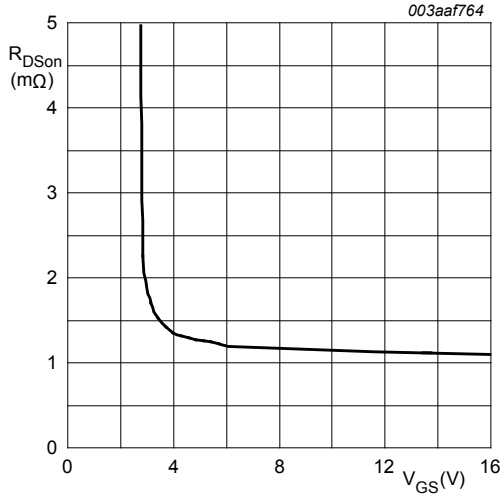


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

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

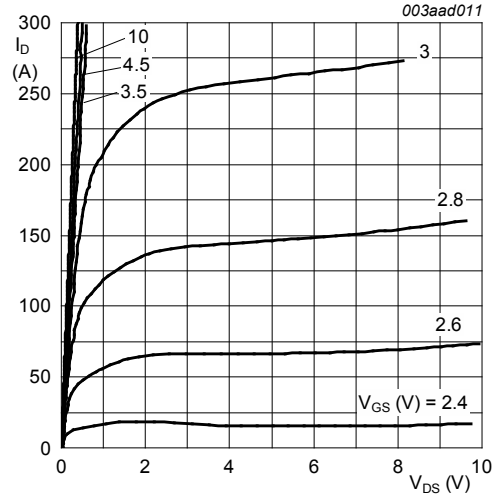


Fig. 8. Output characteristics: drain current as a function of drain-source voltage; typical values

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

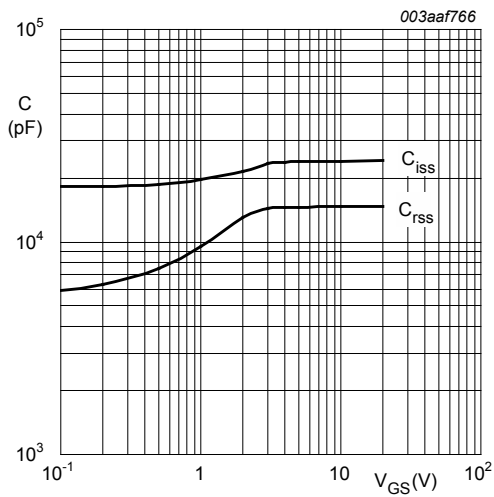


Fig. 9. Input and reverse transfer capacitances as a function of gate-source voltage; typical values

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

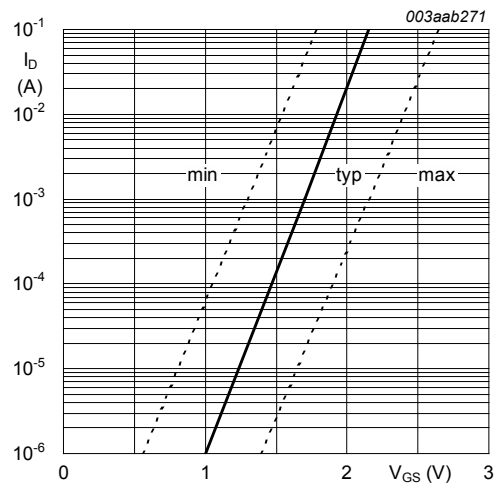


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

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

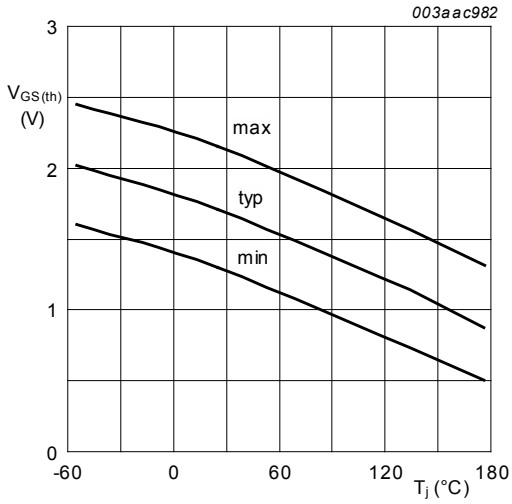


Fig. 11. Gate-source threshold voltage as a function of junction temperature

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

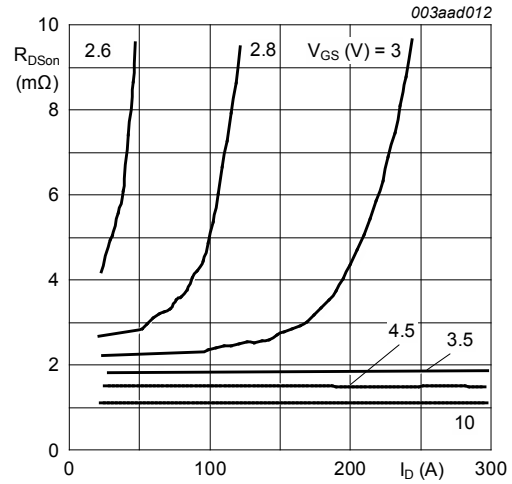


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

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

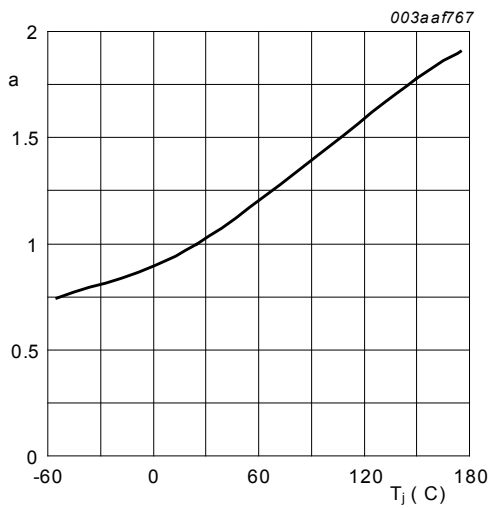


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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

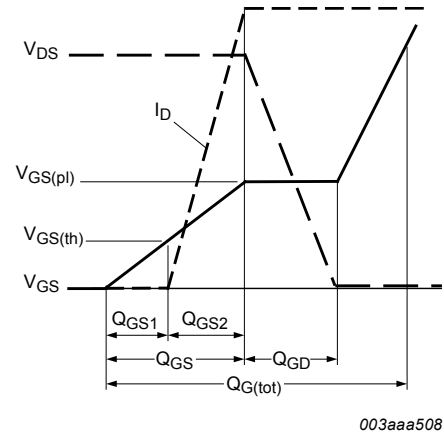


Fig. 14. Gate charge waveform definitions

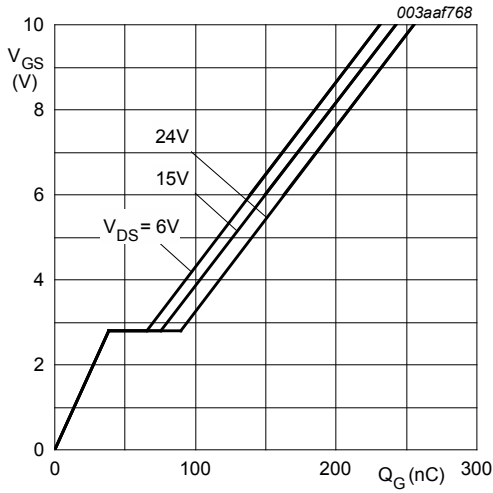


Fig. 15. Gate-source voltage as a function of gate charge; typical values

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

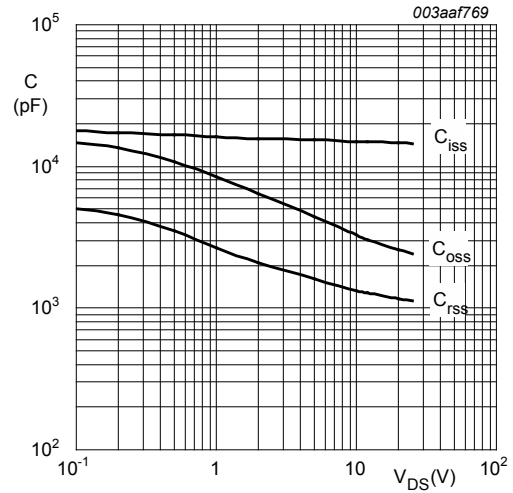


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

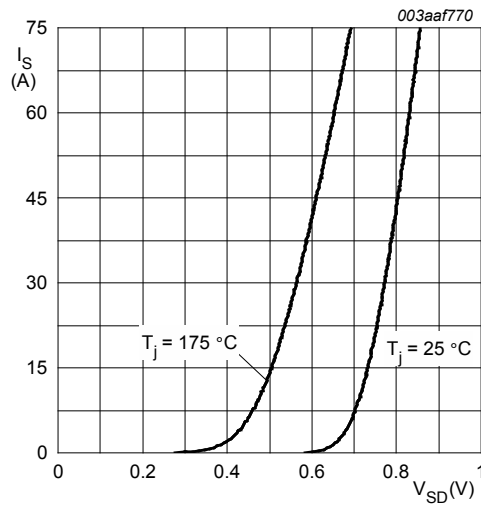


Fig. 17. Source current as a function of source-drain voltage; typical values

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

11. Package outline

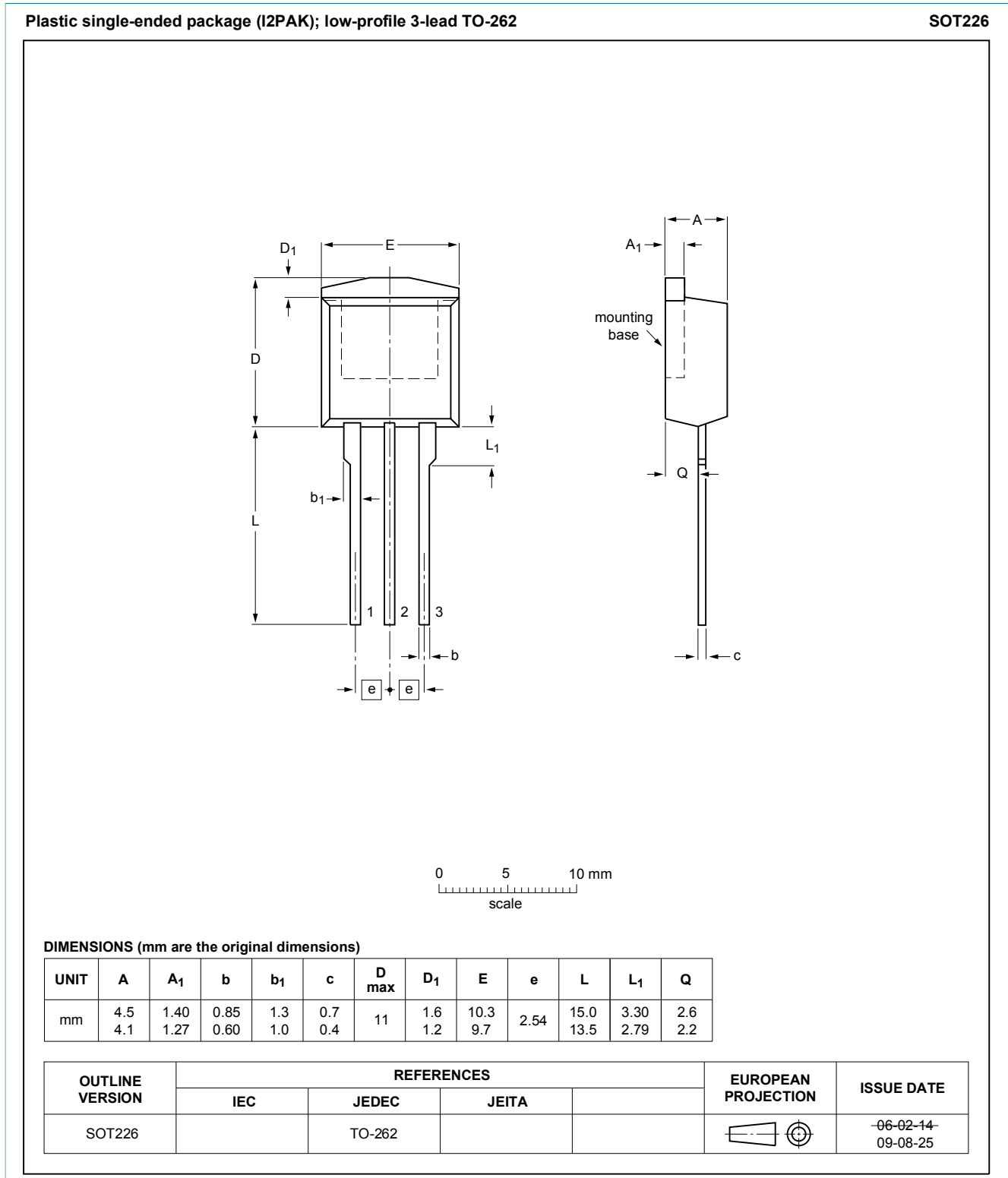


Fig. 18. Package outline I2PAK (SOT226)

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Document status [1][2]	Product status [3]	Definition
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