

1. Product profile

1.1 General description

Standard level N-channel MOSFET in LPAK 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

- Advanced TrenchMOS provides low RDSon and low gate charge
- High efficiency gains in switching power converters
- Improved mechanical and thermal characteristics
- LPAK provides maximum power density in a Power SO8 package

1.3 Applications

- DC-to-DC converters
- Lithium-ion battery protection
- Load switching
- Motor control
- 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 ≥ 25 °C; T _j ≤ 175 °C	-	-	60	V
I _D	drain current	T _{mb} = 25 °C; V _{GS} = 10 V; see Figure 1	-	-	59	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; see Figure 2	-	-	89	W
T _j	junction temperature		-55	-	175	°C
Avalanche ruggedness						
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	V _{GS} = 10 V; T _{j(init)} = 25 °C; I _D = 59 A; V _{sup} ≤ 60 V; R _{GS} = 50 Ω	-	-	71	mJ
Dynamic characteristics						
Q _{GD}	gate-drain charge	V _{GS} = 10 V; I _D = 30 A;	-	6.4	-	nC
Q _{G(tot)}	total gate charge	V _{DS} = 30 V; see Figure 14 and 15	-	28.4	-	nC

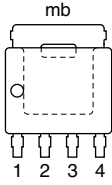
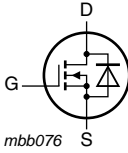
N-channel LPAK 60 V, 11.1 mΩ standard level MOSFET

Table 1. Quick reference ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 100\text{ }^\circ\text{C};$ see Figure 12	-	-	17.8	mΩ
		$V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 25\text{ }^\circ\text{C};$ see Figure 13	-	8	11.1	mΩ

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source		
2	S	source		
3	S	source		
4	G	gate		
mb	D	mounting base; connected to drain		

SOT669 (LPAK)

3. Ordering information

Table 3. Ordering information

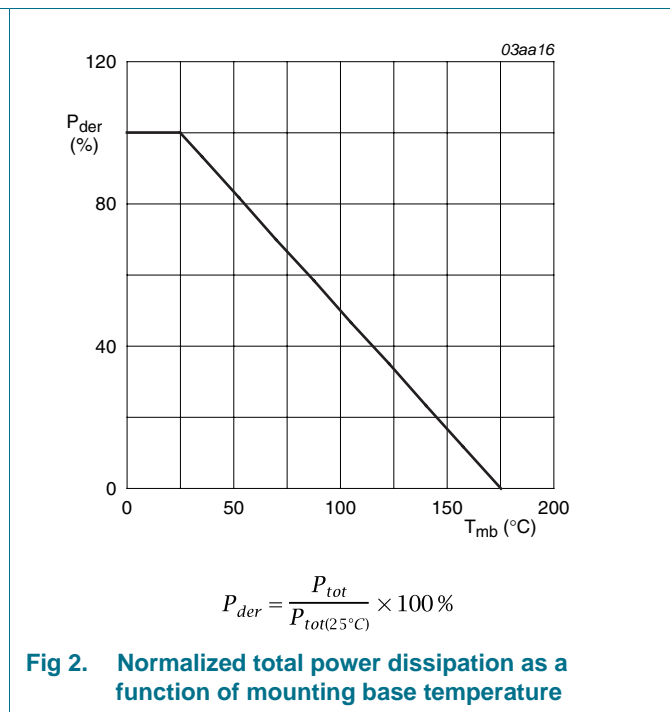
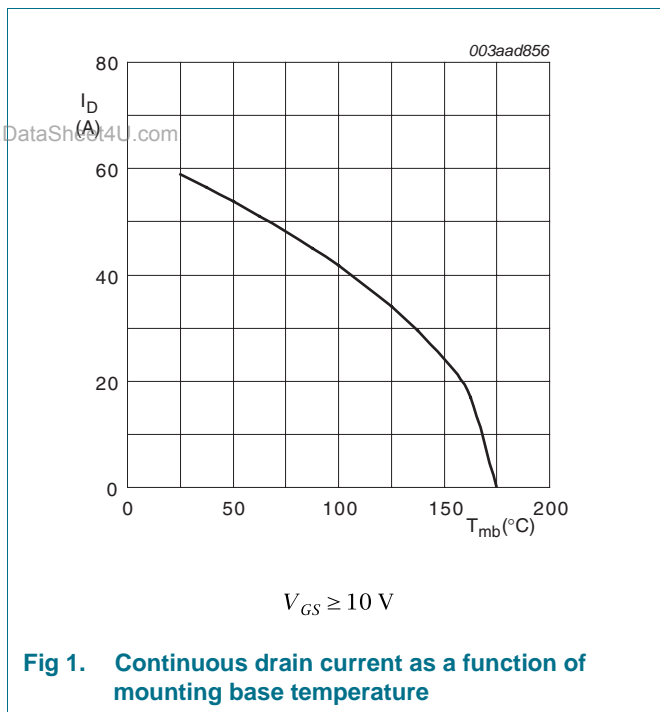
Type number	Package		Version
	Name	Description	
PSMN012-60YS	LPAK	plastic single-ended surface-mounted package (LPAK); 4 leads	SOT669

4. Limiting values

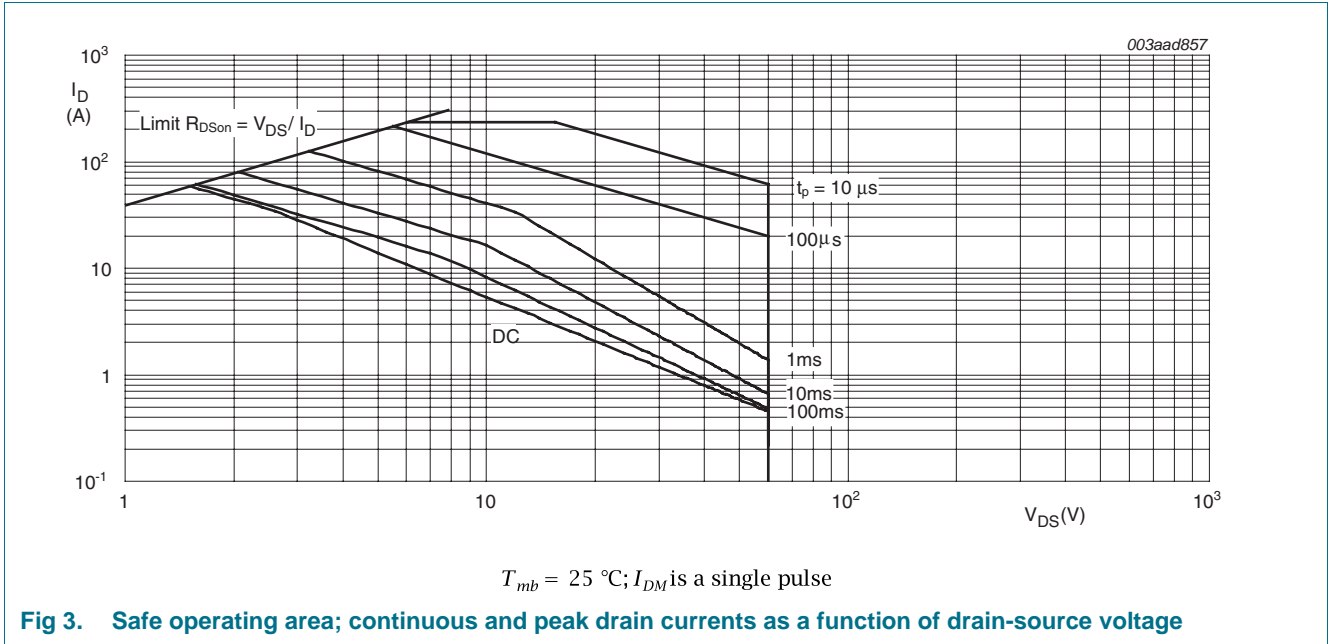
Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V _{DS}	drain-source voltage	T _j ≥ 25 °C; T _j ≤ 175 °C	-	60	V
V _{DGR}	drain-gate voltage	T _j ≥ 25 °C; T _j ≤ 175 °C; R _{GS} = 20 kΩ	-	60	V
V _{GS}	gate-source voltage		-20	20	V
I _D	drain current	V _{GS} = 10 V; T _{mb} = 100 °C; see Figure 1	-	42	A
		V _{GS} = 10 V; T _{mb} = 25 °C; see Figure 1	-	59	A
I _{DM}	peak drain current	t _p ≤ 10 μs; pulsed; T _{mb} = 25 °C; see Figure 3	-	236	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; see Figure 2	-	89	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 °C	-	59	A
I _{SM}	peak source current	t _p ≤ 10 μs; pulsed; T _{mb} = 25 °C	-	236	A
Avalanche ruggedness					
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	V _{GS} = 10 V; T _{j(init)} = 25 °C; I _D = 59 A; V _{sup} ≤ 60 V; R _{GS} = 50 Ω	-	71	mJ



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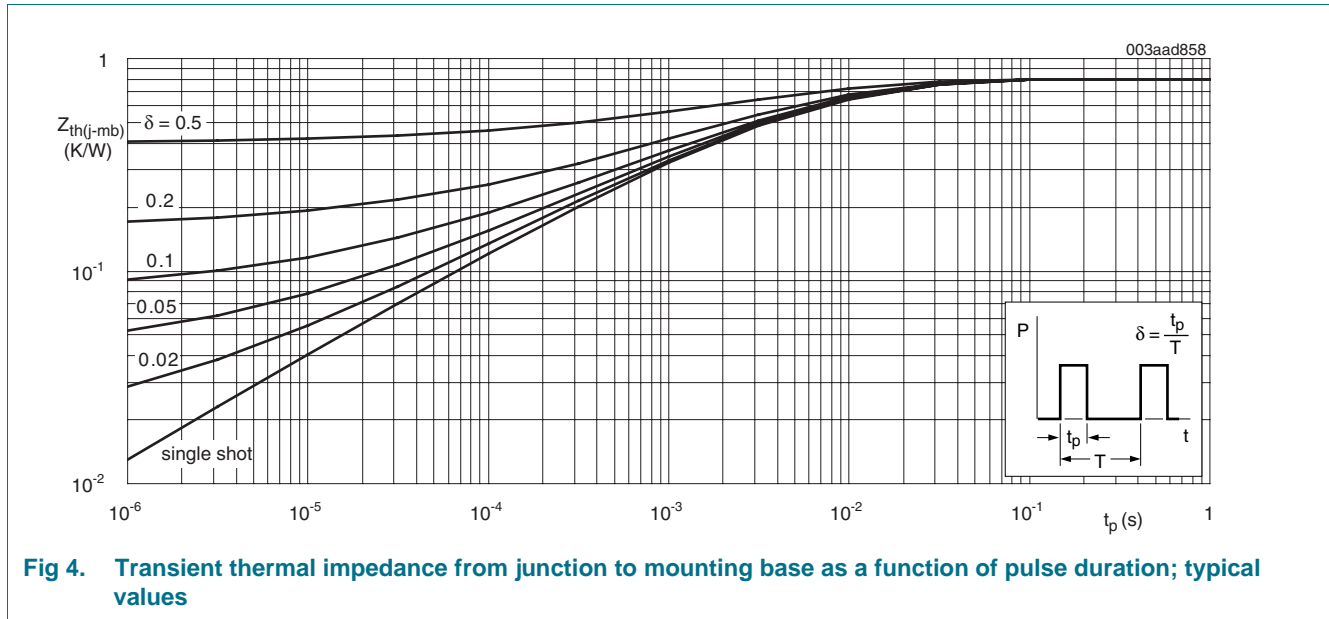


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5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 4	-	0.8	1.68	K/W



6. Characteristics

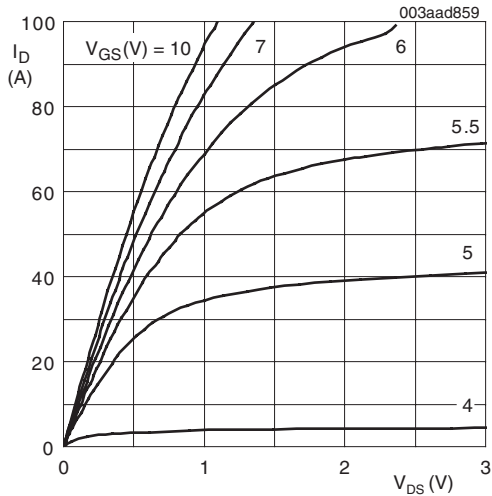
Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	54	-	-	V
		$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	60	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C}$; see Figure 10 and 11	2	3	4	V
V_{GSth}		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C}$; see Figure 11	-	-	4.6	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C}$; see Figure 11	0.95	-	-	V
I_{DSS}	drain leakage current	$V_{DS} = 60 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.03	2	μA
		$V_{DS} = 60 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ\text{C}$	-	-	50	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
		$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	2	100	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 175 \text{ }^\circ\text{C}$; see Figure 12	-	17	25.5	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 100 \text{ }^\circ\text{C}$; see Figure 12	-	-	17.8	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$; see Figure 13	-	8	11.1	mΩ
R_G	gate resistance	$f = 1 \text{ MHz}$	-	0.66	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 30 \text{ A}; V_{DS} = 30 \text{ V}; V_{GS} = 10 \text{ V}$; see Figure 14 and 15	-	28.4	-	nC
		$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$	-	23.3	-	nC
Q_{GS}	gate-source charge	$I_D = 30 \text{ A}; V_{DS} = 30 \text{ V}; V_{GS} = 10 \text{ V}$; see Figure 14 and 15	-	8.75	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge	$I_D = 30 \text{ A}; V_{DS} = 30 \text{ V}; V_{GS} = 10 \text{ V}$; see Figure 14	-	4.9	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	3.9	-	nC
Q_{GD}	gate-drain charge	$I_D = 30 \text{ A}; V_{DS} = 30 \text{ V}; V_{GS} = 10 \text{ V}$; see Figure 14 and 15	-	6.4	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 30 \text{ V}$; see Figure 14 and 15	-	4.8	-	V
C_{iss}	input capacitance	$V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}$; see Figure 16	-	1685	-	pF
C_{oss}	output capacitance		-	245	-	pF
C_{riss}	reverse transfer capacitance		-	140	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30 \text{ V}; R_L = 1 \text{ }^\circ\Omega; V_{GS} = 10 \text{ V}$; $R_{G(ext)} = 4.7 \text{ }^\circ\Omega$	-	15.2	-	ns
t_r	rise time		-	12.6	-	ns
$t_{d(off)}$	turn-off delay time		-	28.7	-	ns
t_f	fall time		-	8.2	-	ns

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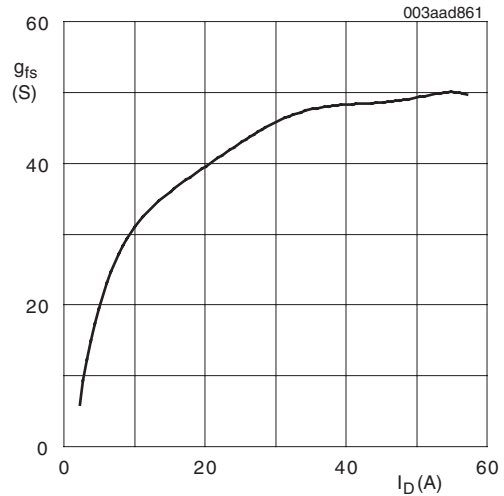
Table 6. Characteristics ...continued

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 17	-	0.82	1.2	V
t_{rr}	reverse recovery time	$I_S = 10\text{ A}$; $di_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$;	-	35	-	ns
Q_r	recovered charge	$V_{DS} = 30\text{ V}$	-	41	-	nC



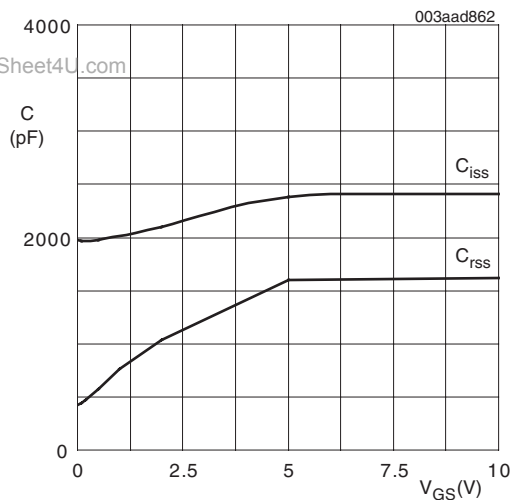
$T_j = 25\text{ °C}$

Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values



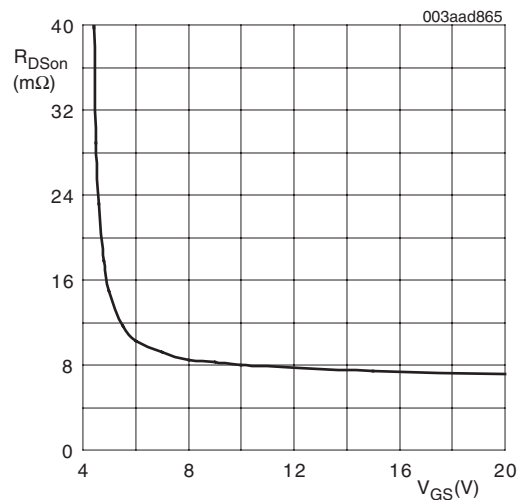
$T_j = 25\text{ °C}$; $V_{DS} = 15\text{ V}$

Fig 6. Forward transconductance as a function of drain current; typical values



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

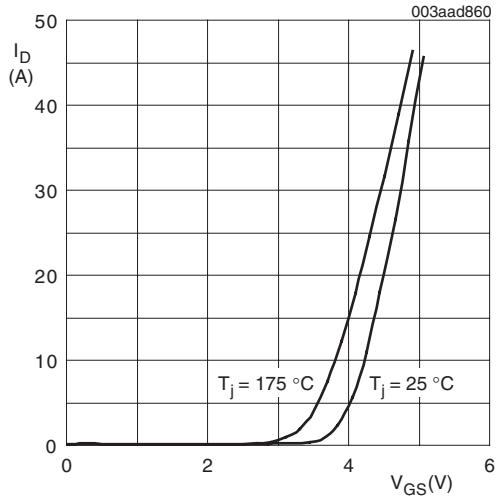
Fig 7. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



$T_j = 25\text{ °C}$; $I_D = 10\text{ A}$

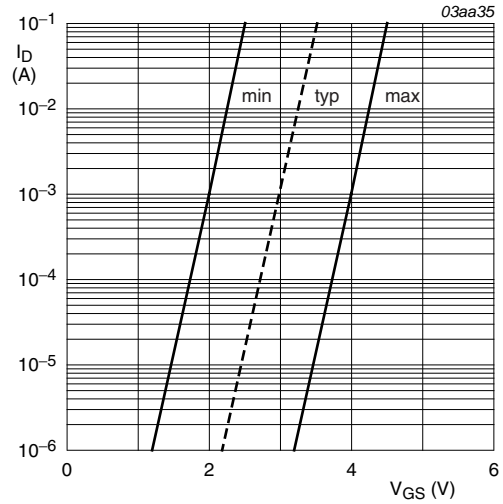
Fig 8. Drain-source on-state resistance as a function of gate-source voltage; typical values

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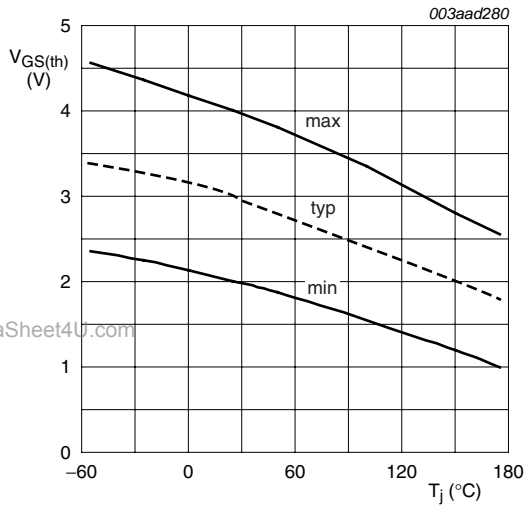
$$V_{DS} > I_D \times R_{DSon}$$

Fig 9. Transfer characteristics: drain current as a function of gate-source voltage; typical values



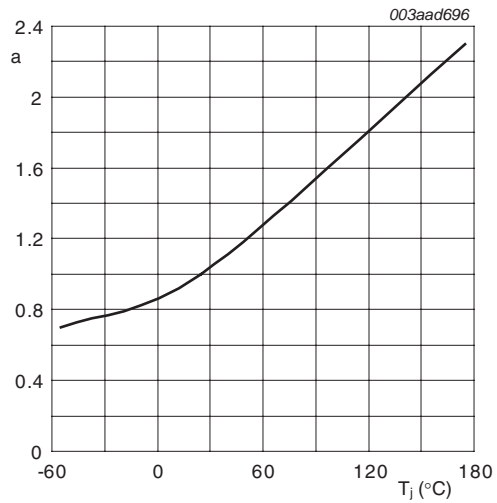
$$T_j = 25\text{ °C}; V_{DS} = 5V$$

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



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

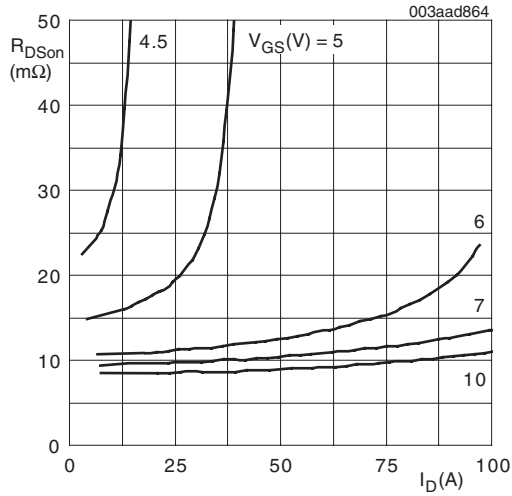
Fig 11. Gate-source threshold voltage as a function of junction temperature



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

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

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$T_j = 25^\circ C$

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

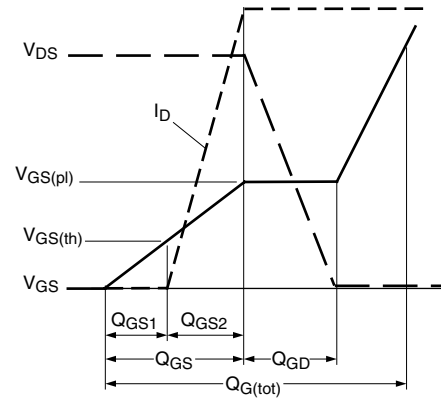
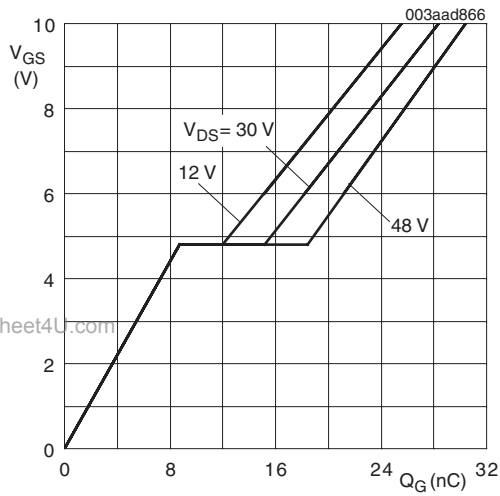
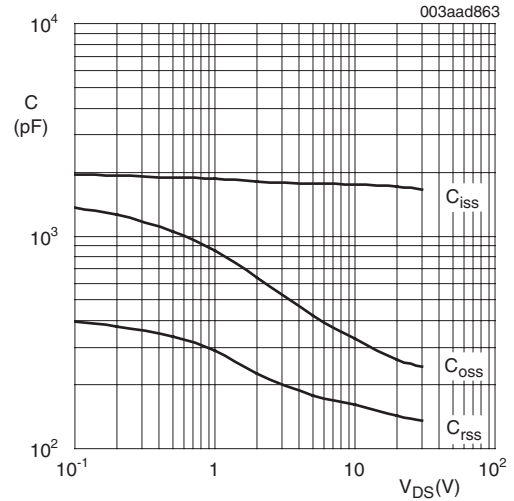


Fig 14. Gate charge waveform definitions



$T_j = 25^\circ C; I_D = 30 A$

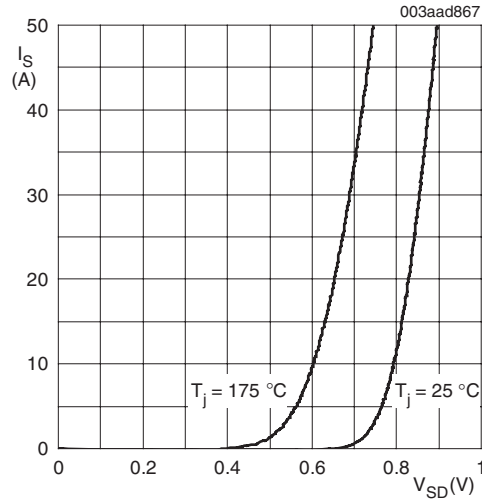
Fig 15. Gate-source voltage as a function of gate charge; typical values



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

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

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$V_{GS} = 0V$

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

7. Package outline

Plastic single-ended surface-mounted package (LPAK); 4 leads

SOT669

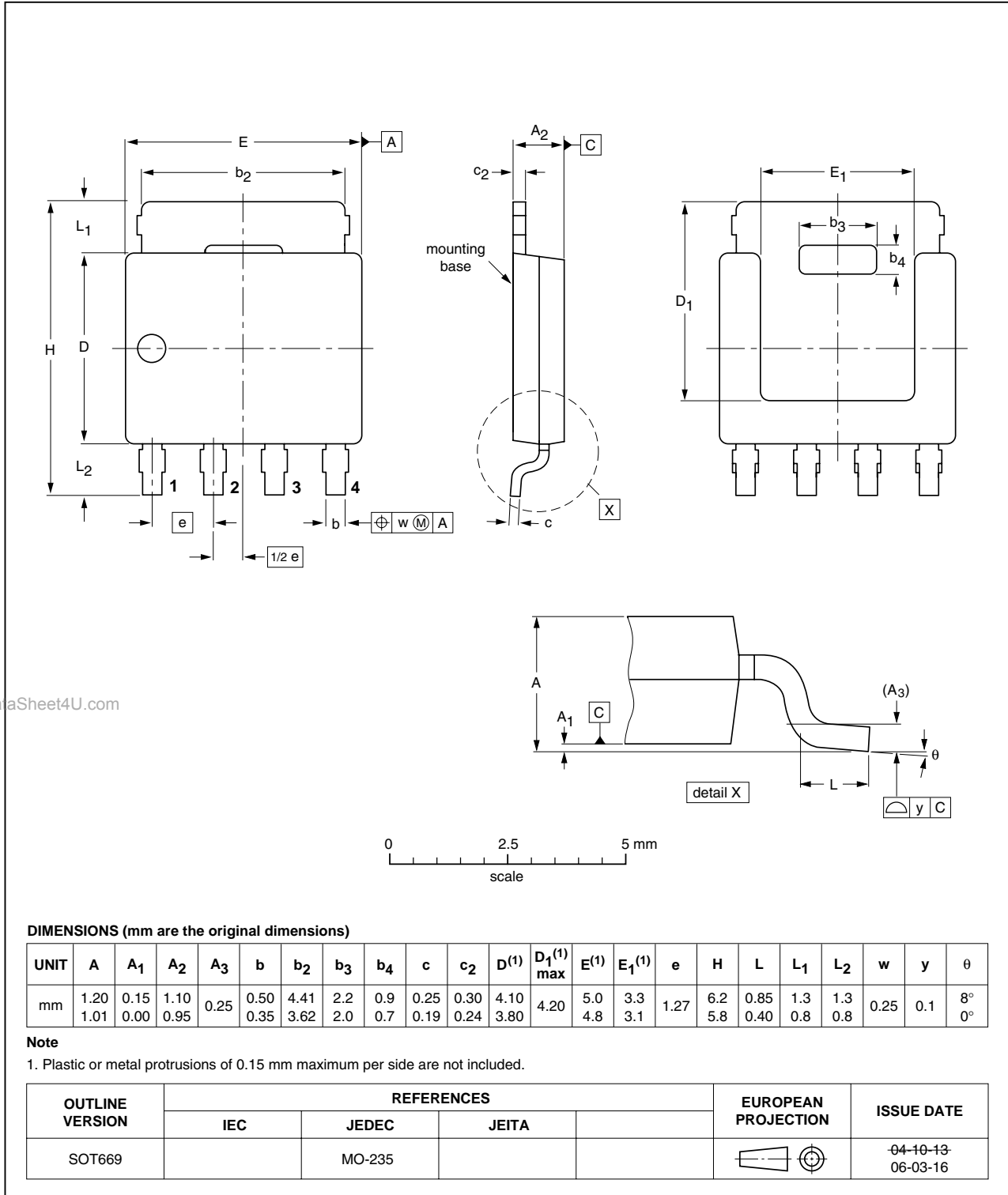


Fig 18. Package outline SOT669 (LPAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN012-60YS_1	20100105	Product 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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