

1. Product profile

1.1 General description

Logic level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using TrenchMOS technology. This product is designed and qualified for use in computing, communications, consumer and industrial applications only.

1.2 Features and benefits

- 100% gate resistance tested
- 100% Ruggedness tested
- Lead-free package
- Logic level compatible
- Optimized for use in DC-to-DC converters
- Very low switching and conduction losses

1.3 Applications

- DC-to-DC converters
- Notebook computers
- Switched-mode power supplies
- Voltage regulators

1.4 Quick reference data

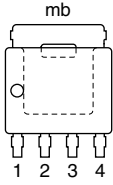
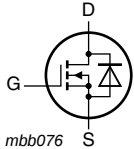
Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 150\text{ °C}$	-	-	25	V
I_D	drain current	$T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; see Figure 1 ; see Figure 3	[1]	-	100	A
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 4.5\text{ V}$; $I_D = 25\text{ A}$; $V_{DS} = 12\text{ V}$; see Figure 12 ; see Figure 13	-	8	-	nC
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; see Figure 10 ; see Figure 11	-	1.4	1.8	mΩ

[1] Continuous current is limited by package.

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 SOT669 (LFPACK)	
2	S	source		
3	S	source		
4	G	gate		
mb	D	mounting base; connected to drain		

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PH1825AL	LFPACK	plastic single-ended surface-mounted package (LFPACK); 4 leads	SOT669

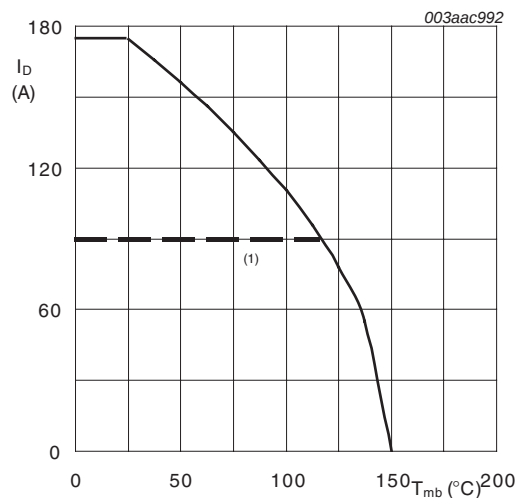
4. Limiting values

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	$T_j \geq 25\text{ °C}$; $T_j \leq 150\text{ °C}$	-	25	V
V_{DGR}	drain-gate voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 150\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	25	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	-	100	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 1 ; see Figure 3	[1]	100	A
I_{DM}	peak drain current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$; see Figure 3	-	697	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	104	W
T_{stg}	storage temperature		-55	150	°C
T_j	junction temperature		-55	150	°C
Source-drain diode					
I_S	source current	$T_{mb} = 25\text{ °C}$; [1]	-	100	A
I_{SM}	peak source current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$	-	697	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 100\text{ A}$; $V_{sup} \leq 25\text{ V}$; $t_p = 0.15\text{ ms}$; $R_{GS} = 50\text{ }\Omega$; unclamped	-	239	mJ

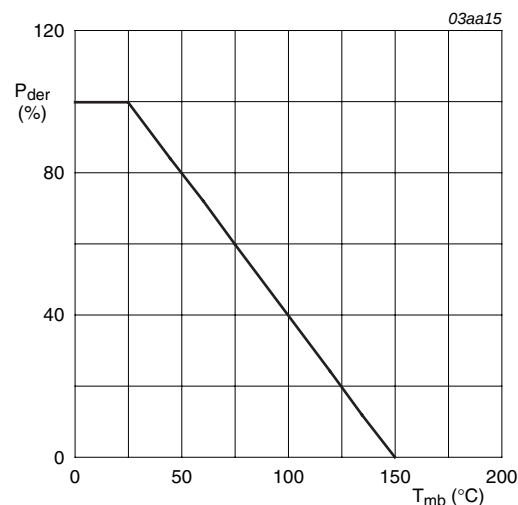
[1] Continuous current is limited by package.



$$V_{GS} \geq 10V$$

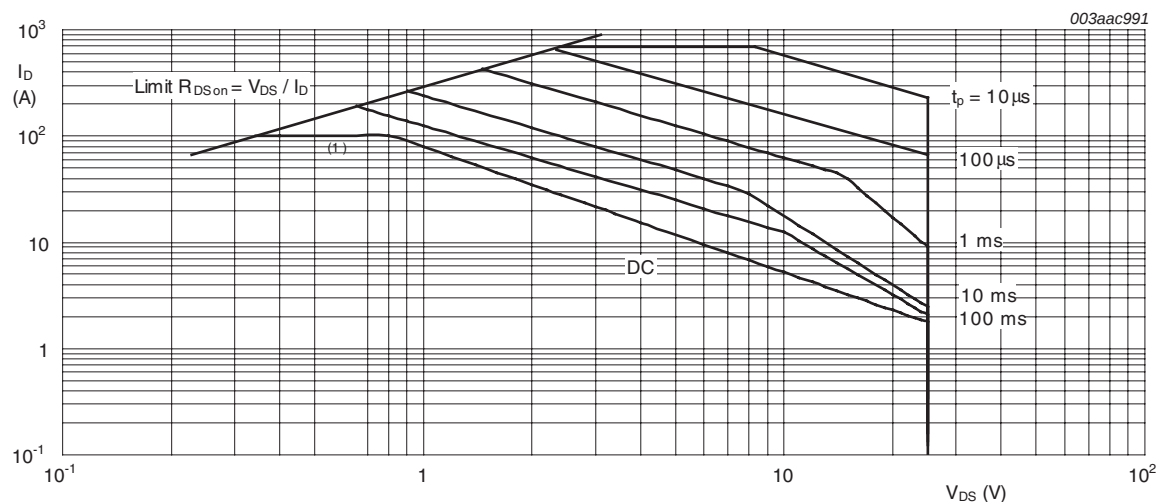
(1) Capped at 100 A due to package.

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



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

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



$$T_{mb} = 25^\circ C; I_{DM} \text{ is single pulse}$$

(1) Capped at 100 A due to package.

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

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	-	-	1.2	K/W

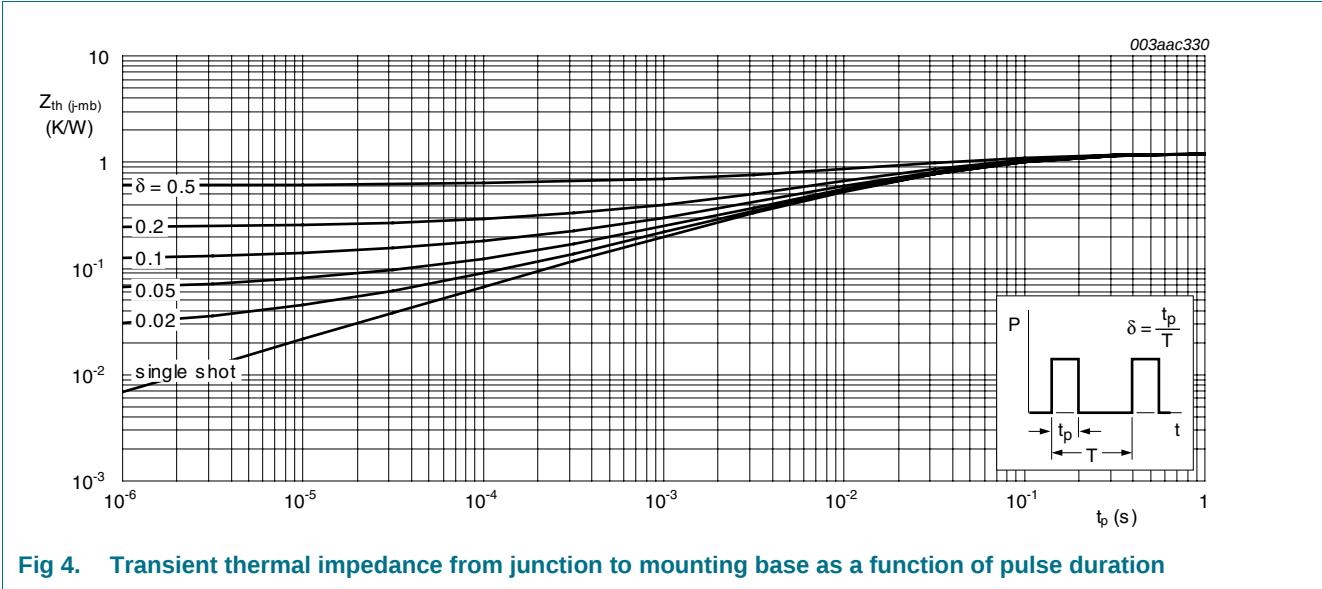


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	25	-	-	V
		$I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$; $T_j = -55\ ^\circ\text{C}$	23.2	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_j = 25\ ^\circ\text{C}$; see Figure 8 ; see Figure 9	1.3	1.7	2.15	V
		$I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_j = 150\ ^\circ\text{C}$; see Figure 8 ; see Figure 9	0.65	-	-	V
		$I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; $T_j = -55\ ^\circ\text{C}$; see Figure 8 ; see Figure 9	-	-	2.45	V
I_{DSS}	drain leakage current	$V_{DS} = 25\ \text{V}$; $V_{GS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	-	-	1	μA
		$V_{DS} = 25\ \text{V}$; $V_{GS} = 0\ \text{V}$; $T_j = 150\ ^\circ\text{C}$	-	-	100	μA
I_{GSS}	gate leakage current	$V_{GS} = 16\ \text{V}$; $V_{DS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	-	-	100	nA
		$V_{GS} = -16\ \text{V}$; $V_{DS} = 0\ \text{V}$; $T_j = 25\ ^\circ\text{C}$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\ \text{V}$; $I_D = 25\ \text{A}$; $T_j = 25\ ^\circ\text{C}$; see Figure 10	-	2	2.7	m Ω
		$V_{GS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; $T_j = 150\ ^\circ\text{C}$; see Figure 10	-	2.4	3.1	m Ω
		$V_{GS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; $T_j = 25\ ^\circ\text{C}$; see Figure 10 ; see Figure 11	-	1.4	1.8	m Ω
R_G	gate resistance	$f = 1\ \text{MHz}$	-	0.95	1.5	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 25\ \text{A}$; $V_{DS} = 12\ \text{V}$; $V_{GS} = 4.5\ \text{V}$; see Figure 12 ; see Figure 13	-	31	-	nC
		$I_D = 0\ \text{A}$; $V_{DS} = 0\ \text{V}$; $V_{GS} = 4.5\ \text{V}$	-	24.5	-	nC
Q_{GS}	gate-source charge	$I_D = 25\ \text{A}$; $V_{DS} = 12\ \text{V}$; $V_{GS} = 4.5\ \text{V}$; see Figure 12 ; see Figure 13	-	10.4	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	5.4	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	5	-	nC
Q_{GD}	gate-drain charge		-	8	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 12\ \text{V}$; see Figure 12 ; see Figure 13	-	2.54	-	V
C_{iss}	input capacitance	$V_{DS} = 12\ \text{V}$; $V_{GS} = 0\ \text{V}$; $f = 1\ \text{MHz}$; $T_j = 25\ ^\circ\text{C}$; see Figure 14	-	4300	-	pF
		$V_{DS} = 0\ \text{V}$; $V_{GS} = 0\ \text{V}$; $f = 1\ \text{MHz}$; $T_j = 25\ ^\circ\text{C}$	-	4800	-	pF
C_{oss}	output capacitance	$V_{DS} = 12\ \text{V}$; $V_{GS} = 0\ \text{V}$; $f = 1\ \text{MHz}$; $T_j = 25\ ^\circ\text{C}$; see Figure 14	-	1100	-	pF
C_{rss}	reverse transfer capacitance		-	390	-	pF

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{d(on)}$	turn-on delay time	$V_{DS} = 12\text{ V}; R_L = 0.5\text{ }\Omega; V_{GS} = 4.5\text{ V};$ $R_{G(ext)} = 5.6\text{ }\Omega$	-	47	-	ns
t_r	rise time		-	72	-	ns
$t_{d(off)}$	turn-off delay time		-	54	-	ns
t_f	fall time		-	29	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 25\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C};$ see Figure 15	-	0.82	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}; dI_S/dt = -100\text{ A/s}; V_{GS} = 0\text{ V};$	-	43	-	ns
Q_r	recovered charge	$V_{DS} = 25\text{ V}$	-	53	-	nC

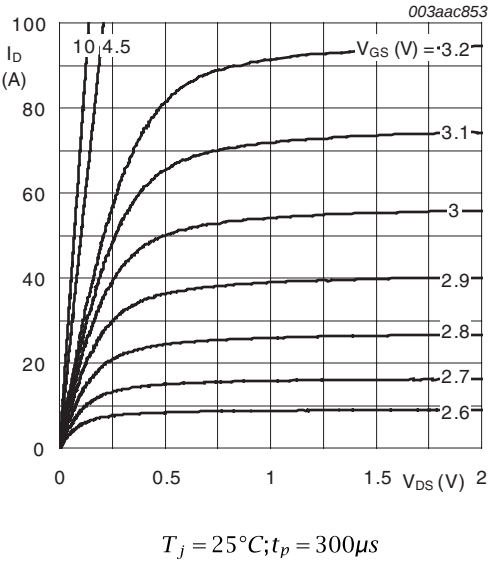


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

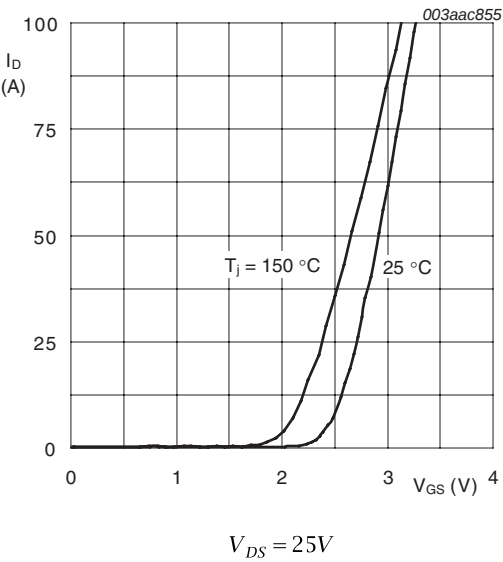
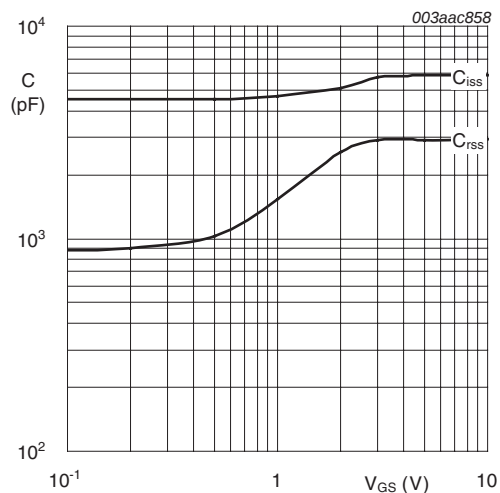
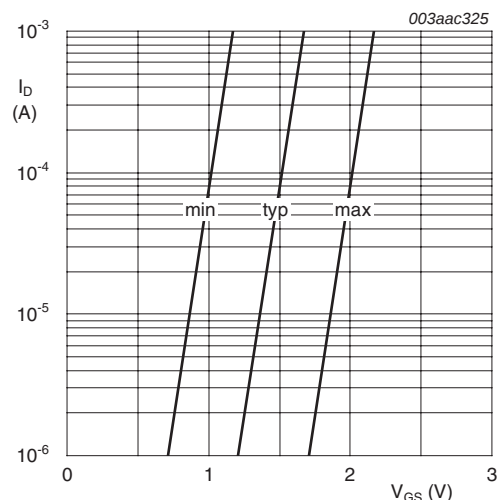


Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values



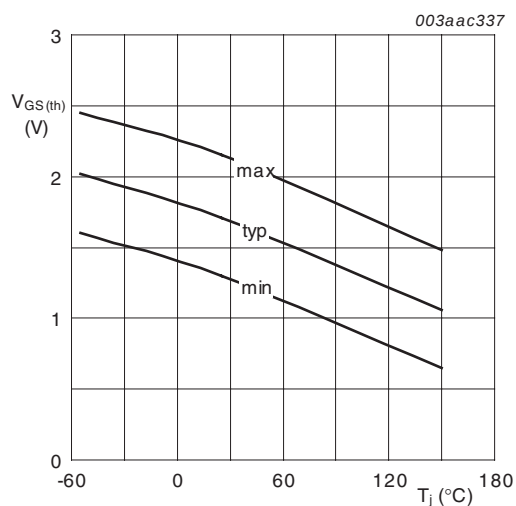
$$V_{DS} = 0V; f = 1MHz$$

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



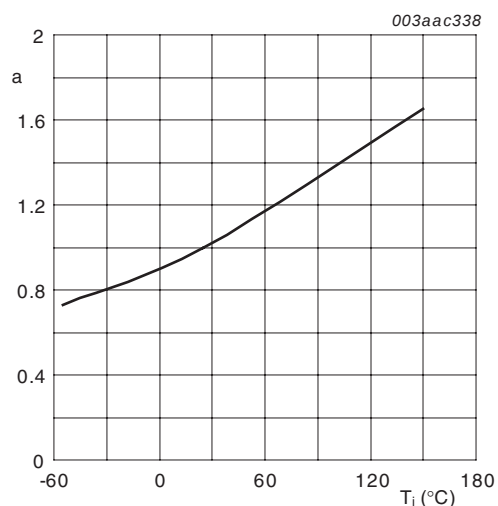
$$T_j = 25^\circ C; V_{DS} = 25V$$

Fig 8. Sub-threshold drain current as a function of gate-source voltage



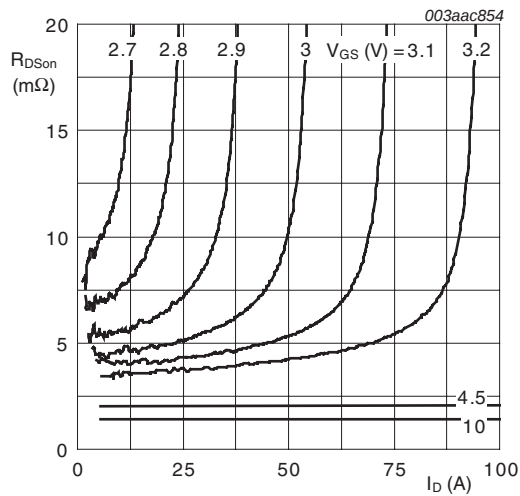
$$I_D = 1mA; V_{DS} = V_{GS}$$

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



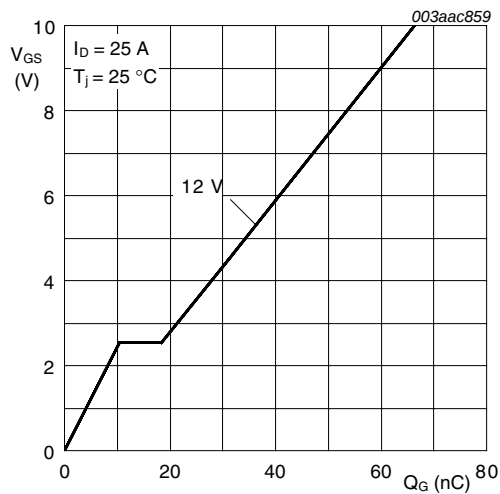
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ C)}}$$

Fig 10. Normalized drain-source on-state resistance factor as a function of junction temperature



$T_j = 25^\circ C$

Fig 11. Drain-source on-state resistance as a function of drain current; typical values.



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

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

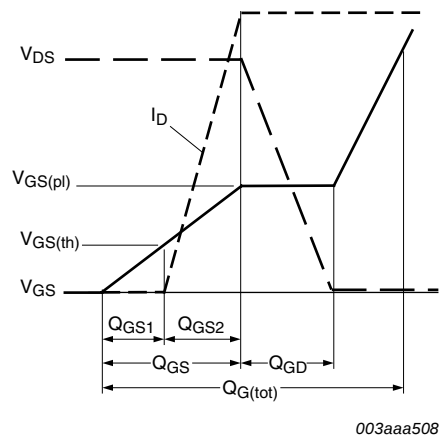
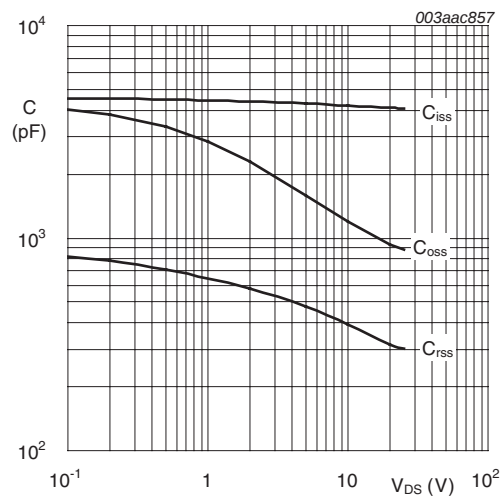


Fig 12. Gate charge waveform definitions



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

Fig 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

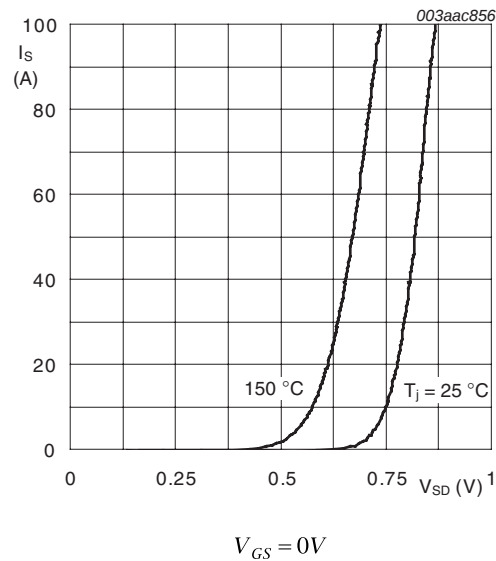


Fig 15. Source current as a function of source drain voltage; typical values.

7. Package outline

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

SOT669

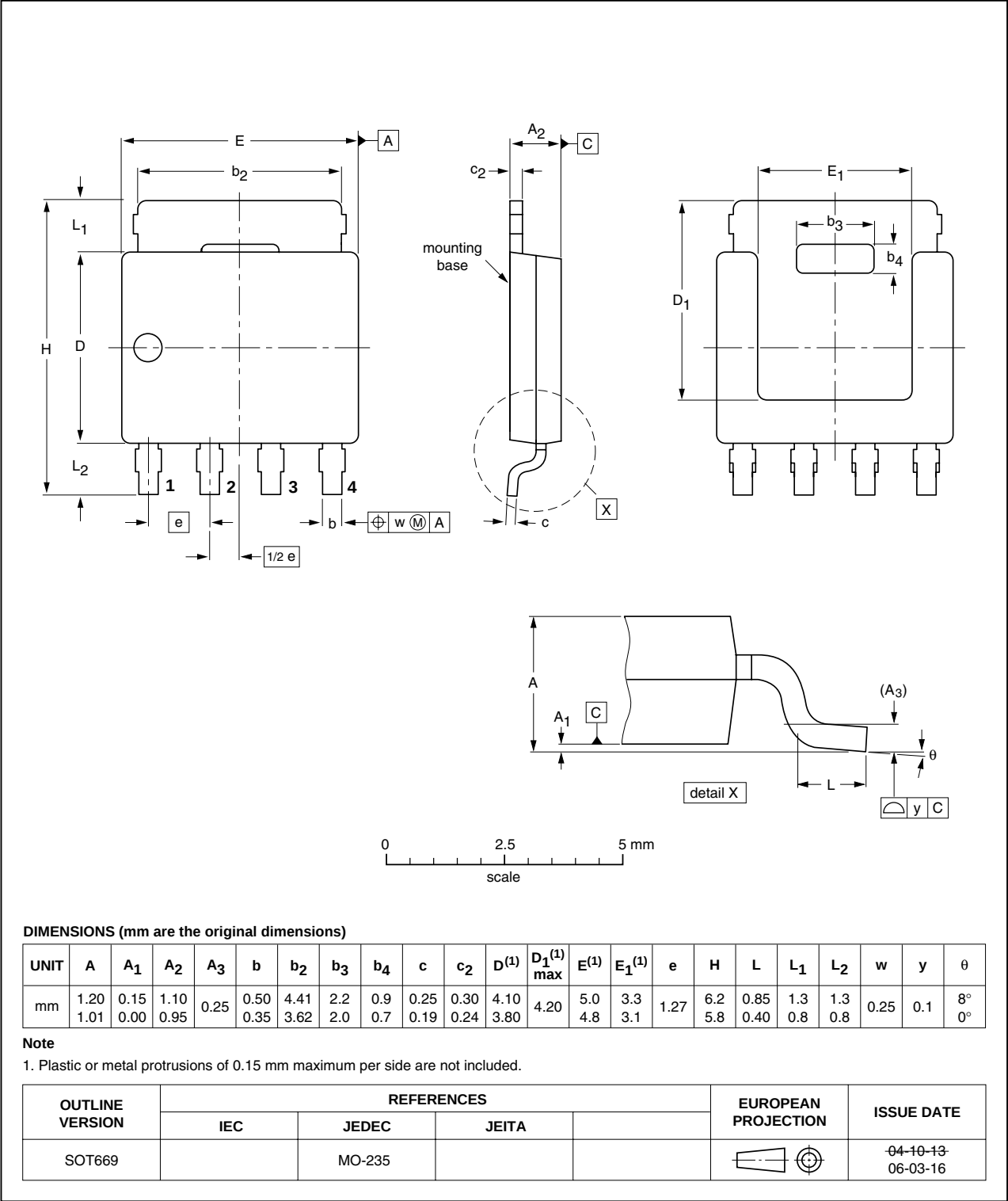


Fig 16. Package outline SOT669 (LPAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PH1825AL_1	20090422	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".

[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.nxp.com>.

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