

PH1875L

N-channel TrenchMOS logic level FET

Rev. 01 — 29 November 2005

Product data sheet

1. Product profile

1.1 General description

Logic level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using TrenchMOS technology.

1.2 Features

- Logic level threshold
- Low thermal resistance
- Very low on-state resistance
- Surface-mounted package

1.3 Applications

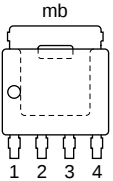
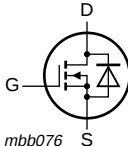
- DC motor control
- DC-to-DC converters
- General purpose power switching

1.4 Quick reference data

- $V_{DS} \leq 75 \text{ V}$
- $I_D \leq 45.8 \text{ A}$
- $R_{DS(on)} \leq 16.5 \text{ m}\Omega$
- $Q_{GD} = 15.3 \text{ nC (typ)}$

2. Pinning information

Table 1: Pinning

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

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3. Ordering information

Table 2: Ordering information

Type number	Package		
	Name	Description	Version
PH1875L	LFPAK	plastic single-ended surface mounted package; 4 leads	SOT669

4. Limiting values

Table 3: Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$25\text{ °C} \leq T_j \leq 150\text{ °C}$	-	75	V
V_{DGR}	drain-gate voltage (DC)	$25\text{ °C} \leq T_j \leq 150\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	75	V
V_{GS}	gate-source voltage		-	± 15	V
I_D	drain current	$T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; see Figure 2 and 3	-	45.8	A
		$T_{mb} = 100\text{ °C}$; $V_{GS} = 10\text{ V}$; see Figure 2	-	29	A
I_{DM}	peak drain current	$T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$; see Figure 3	-	183	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 1	-	62.5	W
T_{stg}	storage temperature		-55	+150	°C
T_j	junction temperature		-55	+150	°C
Source-drain diode					
I_S	source current	$T_{mb} = 25\text{ °C}$	-	45.8	A
I_{SM}	peak source current	$T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$	-	183	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	unclamped inductive load; $I_D = 26\text{ A}$; $t_p = 0.11\text{ ms}$; $V_{DS} \leq 75\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 10\text{ V}$; starting at $T_j = 25\text{ °C}$	-	165	mJ

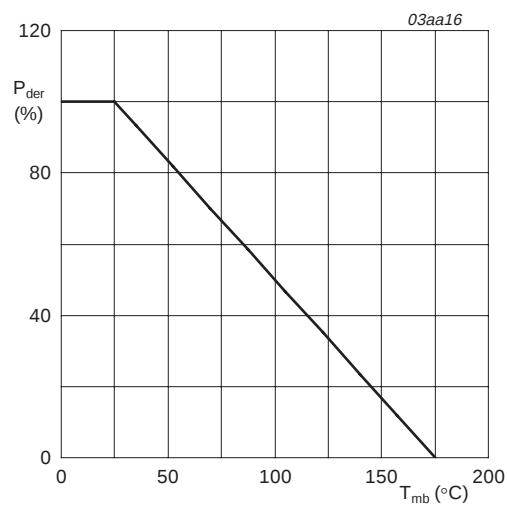


Fig 1. Normalized total power dissipation as a function of mounting base temperature

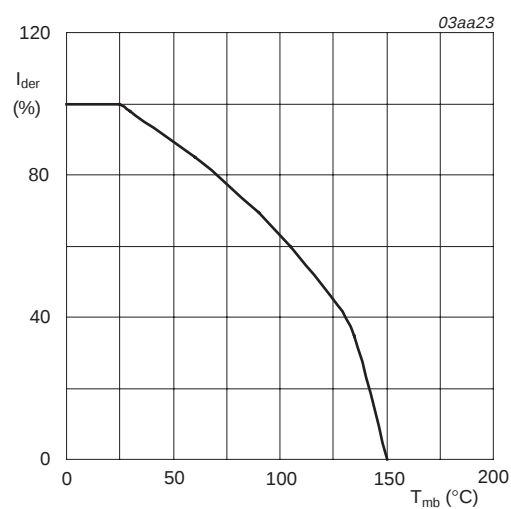


Fig 2. Normalized continuous drain current as a function of mounting base temperature

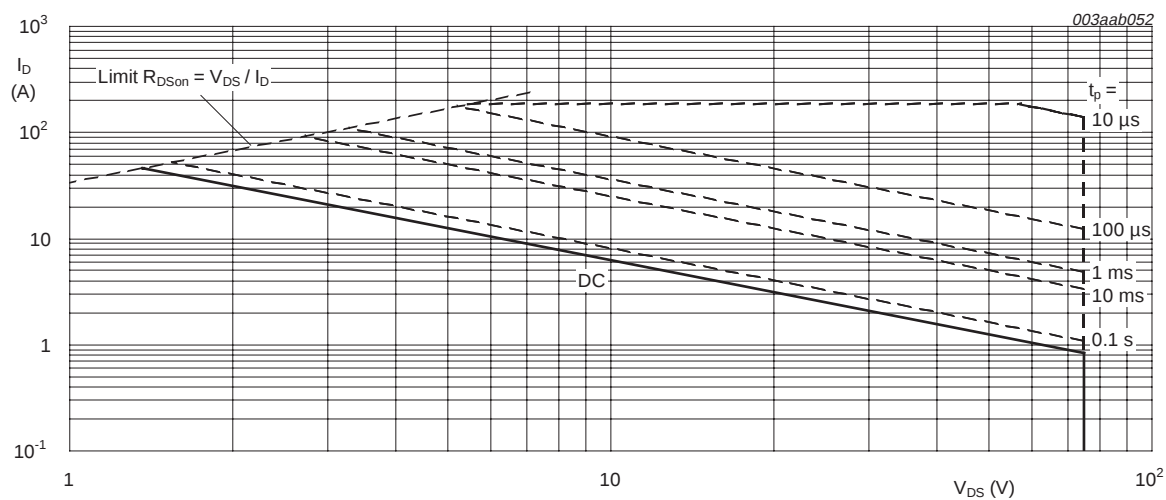


Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

5. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see Figure 4	-	-	2	K/W

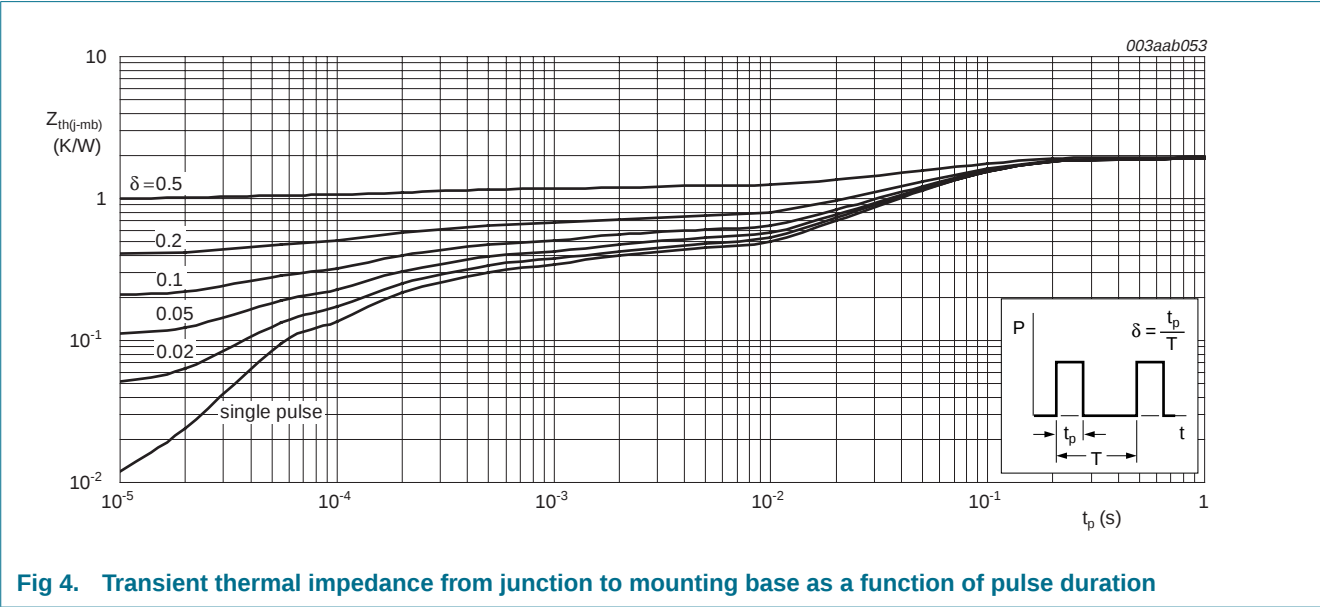
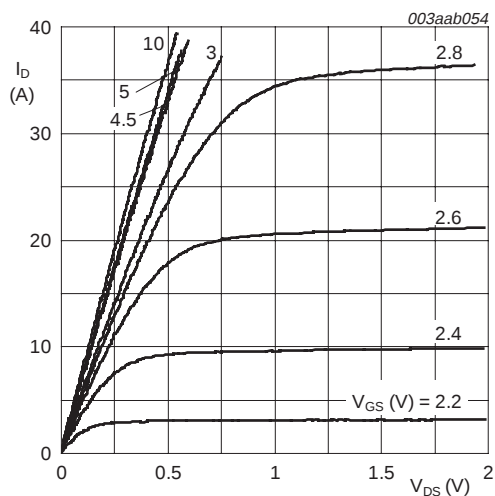


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

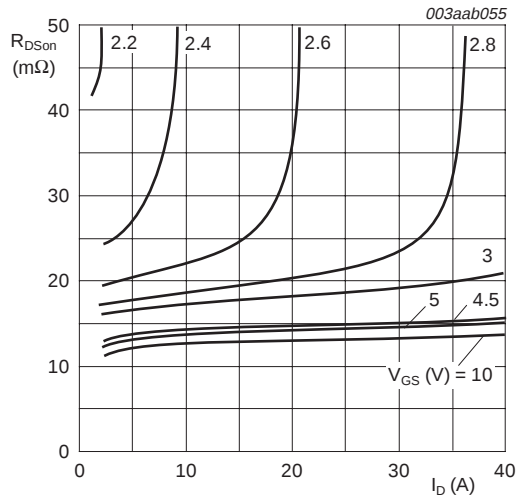
Table 5: Characteristics
 $T_j = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\text{ }\mu\text{A}$; $V_{GS} = 0\text{ V}$ $T_j = 25\text{ }^{\circ}\text{C}$	75	-	-	V
		$T_j = -55\text{ }^{\circ}\text{C}$	68	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$; see Figure 9 and 10 $T_j = 25\text{ }^{\circ}\text{C}$	1	1.5	2	V
		$T_j = 150\text{ }^{\circ}\text{C}$	0.5	-	-	V
		$T_j = -55\text{ }^{\circ}\text{C}$	-	-	2.2	V
I_{DSS}	drain leakage current	$V_{DS} = 75\text{ V}$; $V_{GS} = 0\text{ V}$ $T_j = 25\text{ }^{\circ}\text{C}$	-	-	1	μA
		$T_j = 150\text{ }^{\circ}\text{C}$	-	-	500	μA
I_{GSS}	gate leakage current	$V_{GS} = \pm 15\text{ V}$; $V_{DS} = 0\text{ V}$	-	10	100	nA
R_G	gate resistance	$f = 1\text{ MHz}$	-	1	-	Ω
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 20\text{ A}$; see Figure 6 and 8 $T_j = 25\text{ }^{\circ}\text{C}$	-	13.3	16.5	m Ω
		$T_j = 150\text{ }^{\circ}\text{C}$	-	24.2	30	m Ω
		$V_{GS} = 4.5\text{ V}$; $I_D = 20\text{ A}$; see Figure 6 and 8	-	14.6	20	m Ω
		$V_{GS} = 5\text{ V}$; $I_D = 20\text{ A}$; see Figure 6 and 8	-	14.2	18	m Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 25\text{ A}$; $V_{DS} = 60\text{ V}$; $V_{GS} = 5\text{ V}$; see Figure 11 and 12	-	33.4	-	nC
Q_{GS}	gate-source charge		-	6.7	-	nC
Q_{GS1}	pre- $V_{GS(th)}$ gate-source charge		-	3.3	-	nC
Q_{GS2}	post- $V_{GS(th)}$ gate-source charge		-	3.4	-	nC
Q_{GD}	gate-drain charge		-	15.3	-	nC
$V_{GS(pl)}$	gate-source plateau voltage		-	3	-	V
$Q_{G(tot)}$	total gate charge	$I_D = 0\text{ A}$; $V_{DS} = 0\text{ V}$; $V_{GS} = 4.5\text{ V}$	-	23	-	nC
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 25\text{ V}$; $f = 1\text{ MHz}$; see Figure 14	-	2 600	-	pF
C_{oss}	output capacitance		-	285	-	pF
C_{rss}	reverse transfer capacitance		-	150	-	pF
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 0\text{ V}$; $f = 1\text{ MHz}$	-	4000	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 30\text{ V}$; $R_L = 1.2\text{ }\Omega$; $V_{GS} = 5\text{ V}$; $R_G = 10\text{ }\Omega$	-	23	-	ns
t_r	rise time		-	80	-	ns
$t_{d(off)}$	turn-off delay time		-	92	-	ns
t_f	fall time		-	60	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 25\text{ A}$; $V_{GS} = 0\text{ V}$; see Figure 13	-	0.85	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}$; $dI_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$;	-	107	-	ns
Q_r	recovered charge	$V_R = 30\text{ V}$	-	124	-	nC



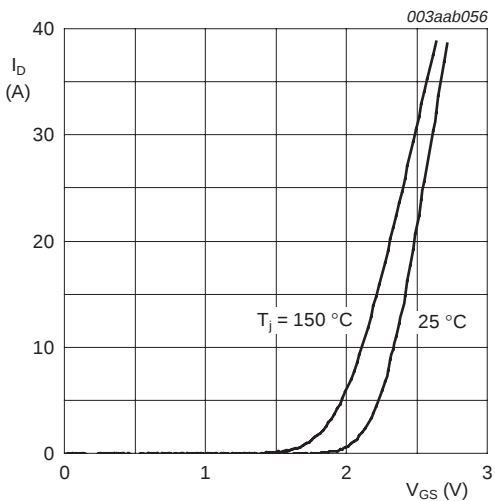
$T_j = 25\text{ }^{\circ}\text{C}$

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



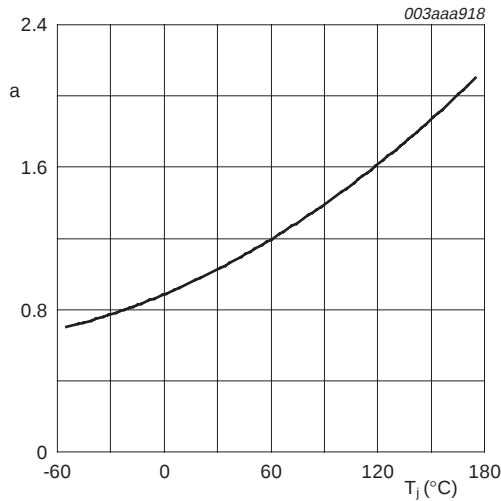
$T_j = 25\text{ }^{\circ}\text{C}$

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



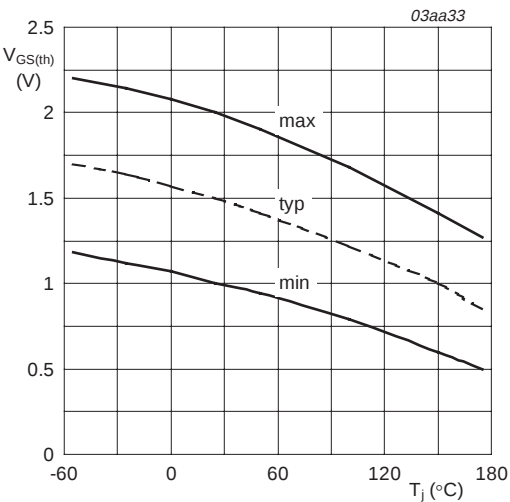
$T_j = 25\text{ }^{\circ}\text{C}$ and $150\text{ }^{\circ}\text{C}$; $V_{DS} > I_D \times R_{DSon}$

Fig 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values



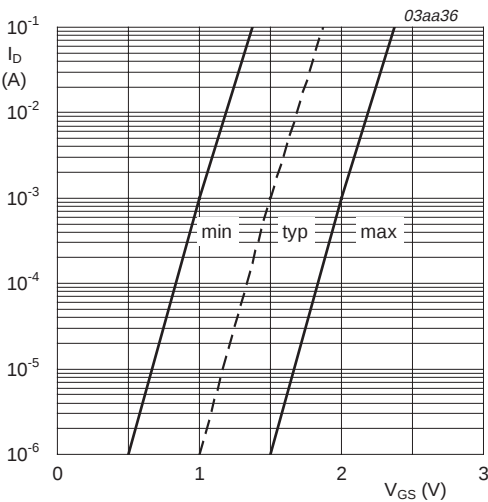
$$a = \frac{R_{DSon}}{R_{DSon(25\text{ }^{\circ}\text{C})}}$$

Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature



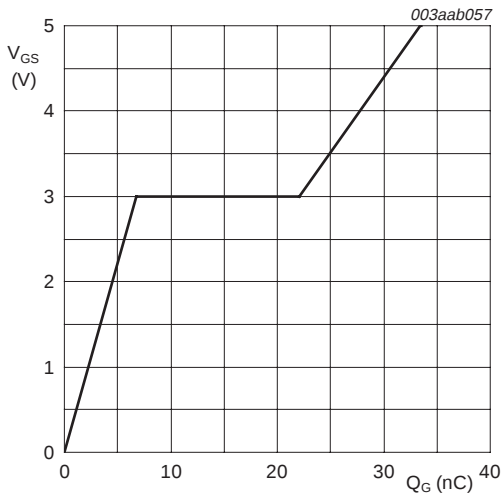
$I_D = 1 \text{ mA}$; $V_{DS} = V_{GS}$

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



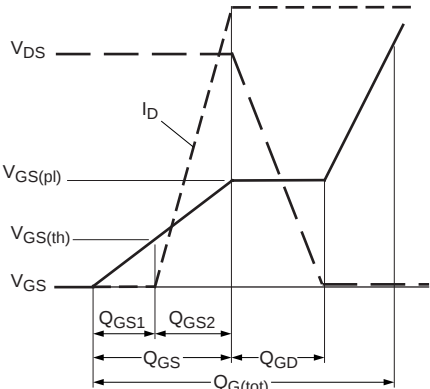
$T_j = 25 \text{ °C}$; $V_{DS} = 5 \text{ V}$

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



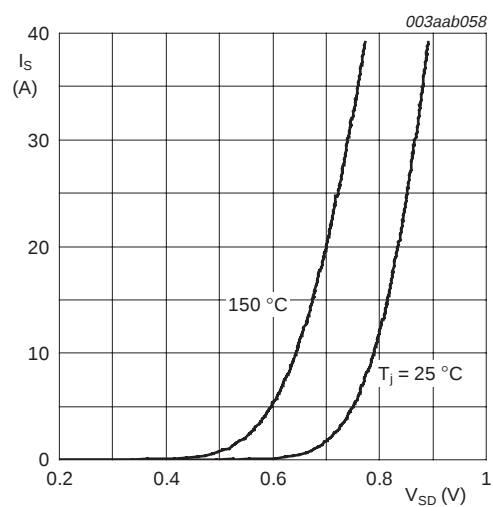
$I_D = 25 \text{ A}$; $V_{DS} = 60 \text{ V}$

Fig 11. Gate-source voltage as a function of gate charge; typical values



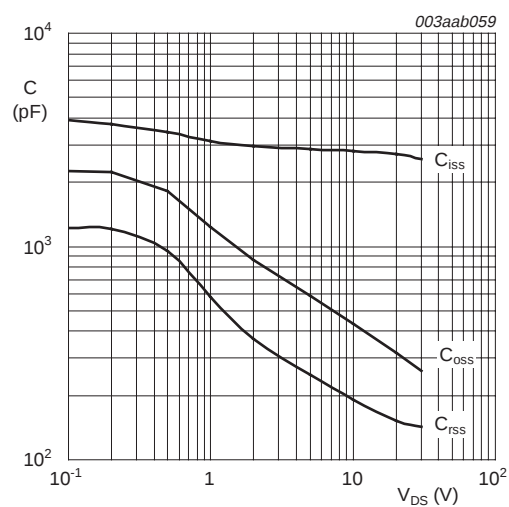
003aaa508

Fig 12. Gate charge waveform definitions



$T_j = 25\text{ }^{\circ}\text{C}$ and $150\text{ }^{\circ}\text{C}$; $V_{GS} = 0\text{ V}$

Fig 13. Source current as a function of source-drain voltage; typical values



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

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

7. Package outline

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

SOT669

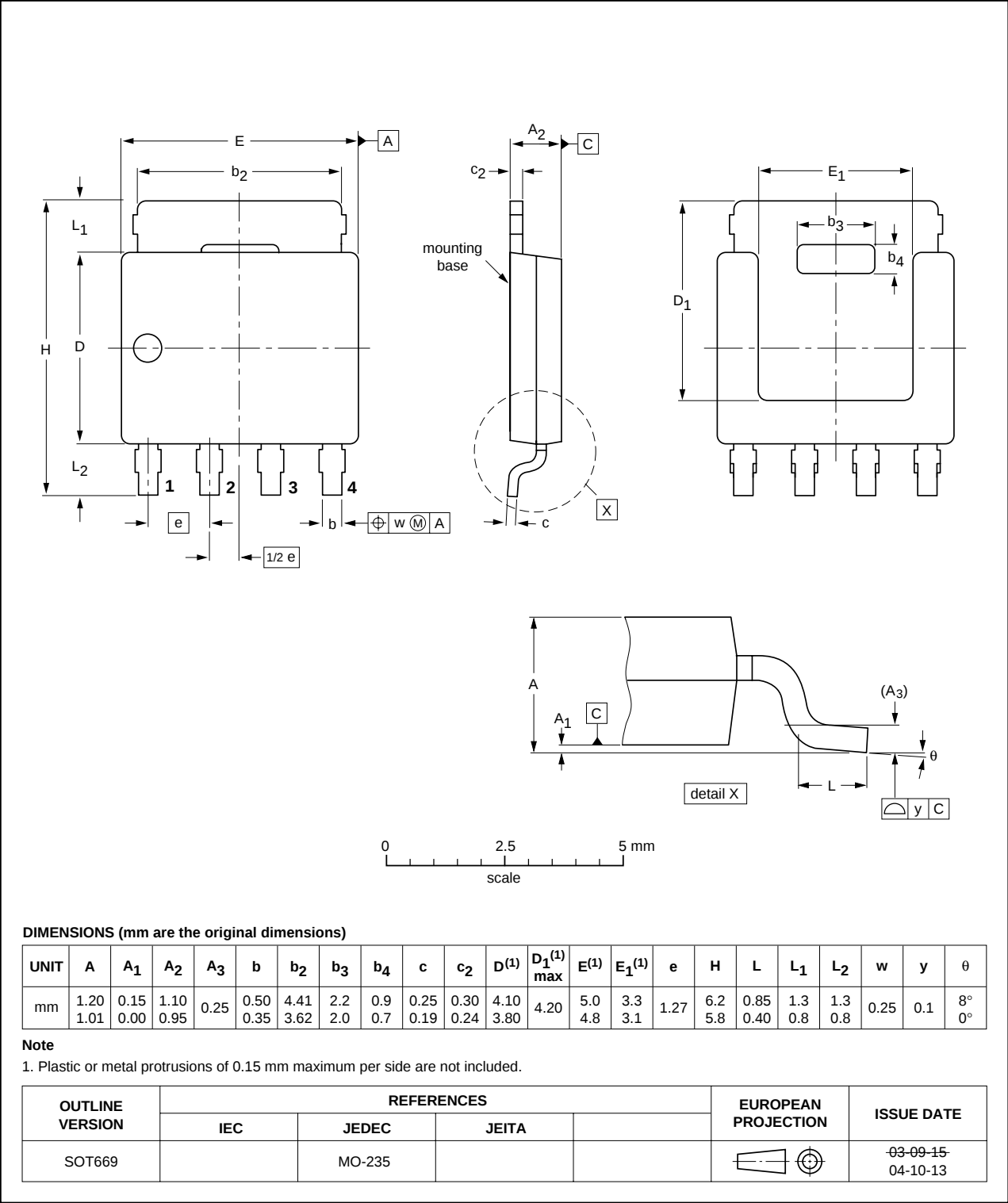


Fig 15. Package outline SOT669 (LPAK)

8. Revision history

Table 6: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
PH1875L_1	20051129	Product data sheet	-	-	-

9. Data sheet status

Level	Data sheet status ^[1]	Product status ^{[2] [3]}	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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