

PH1955L

N-channel TrenchMOS logic level FET

Rev. 01 — 15 August 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
- 175 °C rated
- Low on-state resistance
- Surface-mounted package

1.3 Applications

- DC-to-DC converters
- Motors, lamps and solenoids
- General purpose power switching
- 12 V and 24 V loads

1.4 Quick reference data

- $V_{DS} \leq 55 \text{ V}$
- $R_{DS(on)} \leq 17.3 \text{ m}\Omega$
- $I_D \leq 40 \text{ A}$
- $Q_{GD} = 8 \text{ nC (typ)}$

2. Pinning information

Table 1: Pinning

Pin	Description	Simplified outline	Symbol
1, 2, 3	source (S)	<p style="text-align: center;">SOT669 (LFAK)</p>	<p style="text-align: center;">mbb076</p>
4	gate (G)		
mb	mounting base; connected to drain (D)		

3. Ordering information

Table 2: Ordering information

Type number	Package		
	Name	Description	Version
PH1955L	LFPAK	plastic single-ended surface mounted package; 4 leads	SOT669

4. Limiting values

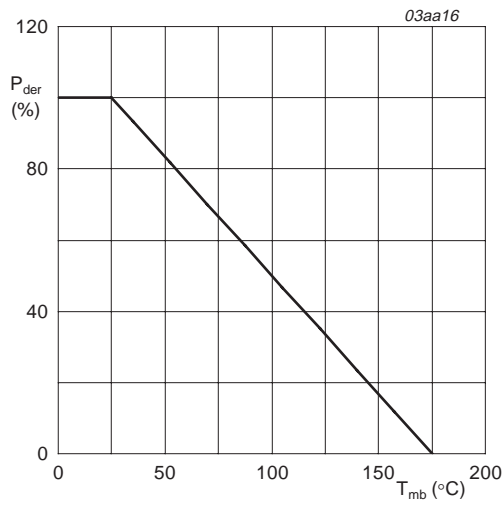
Table 3: Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$	-	55	V
V_{DGR}	drain-gate voltage (DC)	$25\text{ °C} \leq T_j \leq 175\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	55	V
V_{GS}	gate-source voltage		-	± 15	V
I_D	drain current	$T_{mb} = 25\text{ °C}$; $V_{GS} = 5\text{ V}$; see Figure 2 and 3	-	40	A
		$T_{mb} = 100\text{ °C}$; $V_{GS} = 5\text{ V}$; see Figure 2	-	28	A
I_{DM}	peak drain current	$T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$; see Figure 3	-	160	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 1	-	75	W
T_{stg}	storage temperature		-55	+175	°C
T_j	junction temperature		-55	+175	°C
Source-drain diode					
I_S	source current	$T_{mb} = 25\text{ °C}$	-	40	A
I_{SM}	peak source current	$T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$	-	160	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	unclamped inductive load; $I_D = 40\text{ A}$; $t_p = 0.06\text{ ms}$; $V_{DD} \leq 55\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 10\text{ V}$; starting at $T_j = 25\text{ °C}$	-	80	mJ
$E_{DS(AL)R}$	repetitive drain-source avalanche energy	unclamped inductive load; $I_D = 4\text{ A}$; $t_p = 0.06\text{ ms}$; $V_{DD} \leq 55\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 10\text{ V}$	[1] - [2]	0.8	mJ

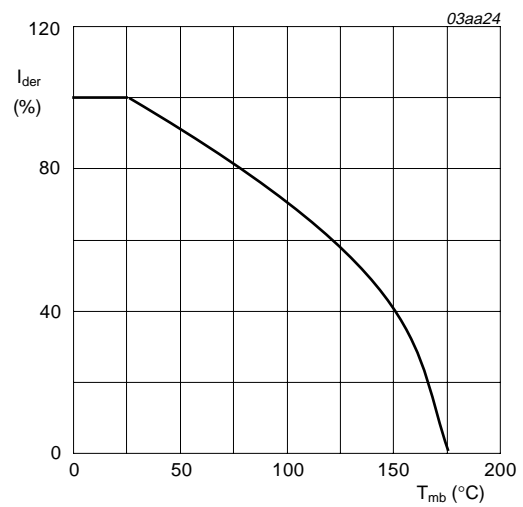
[1] Duty cycle is limited by the maximum junction temperature.

[2] Repetitive avalanche failure is not determined simply by thermal effects. Repetitive avalanche transients should only be applied for short bursts, not every switching cycle.



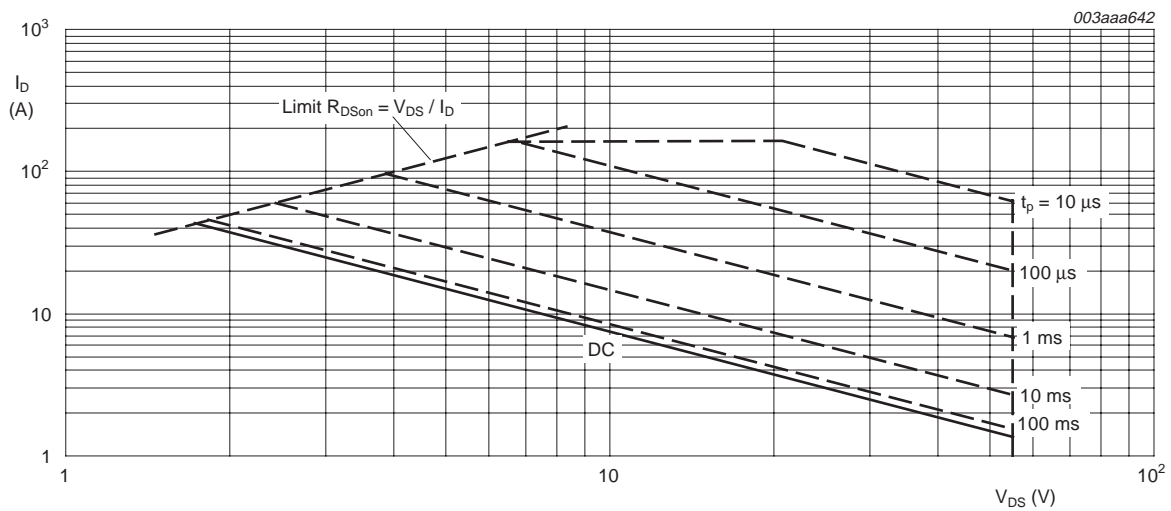
$$P_{der} = \frac{P_{tot}}{P_{tot(25\text{ }^\circ\text{C})}} \times 100\%$$

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



$$I_{der} = \frac{I_D}{I_{D(25\text{ }^\circ\text{C})}} \times 100\%$$

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



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

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

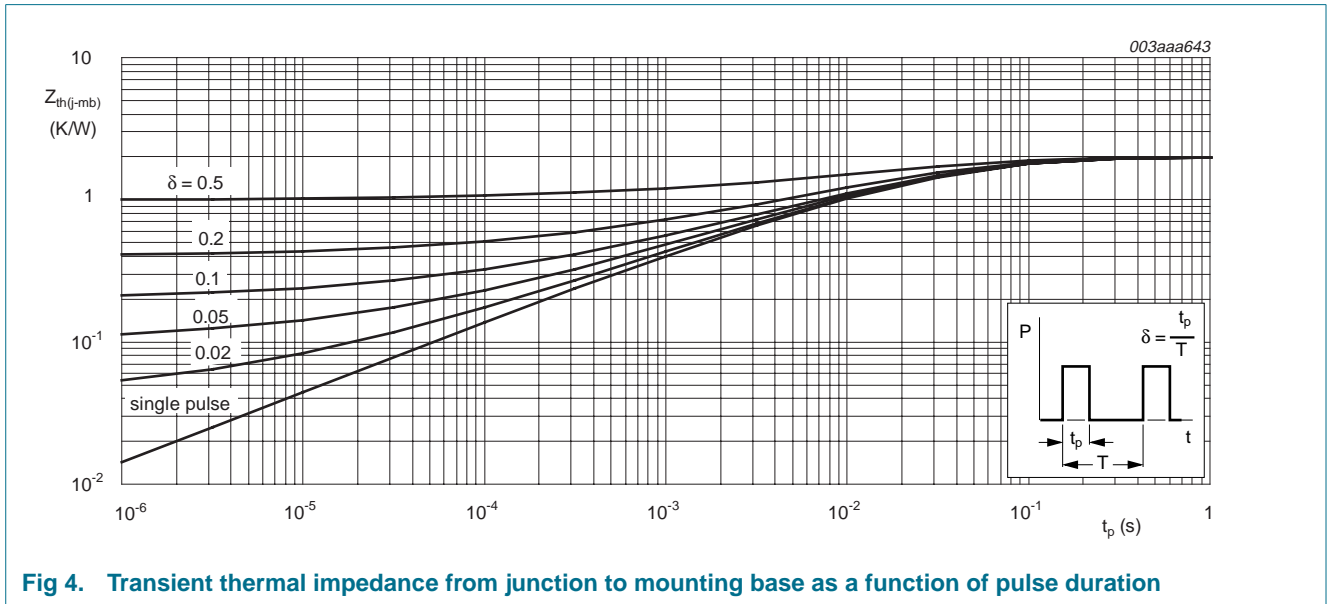
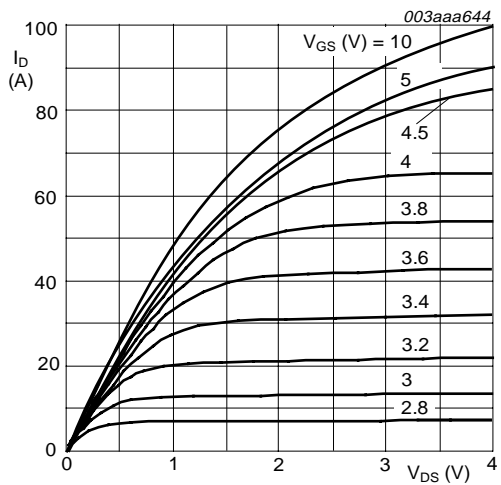


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

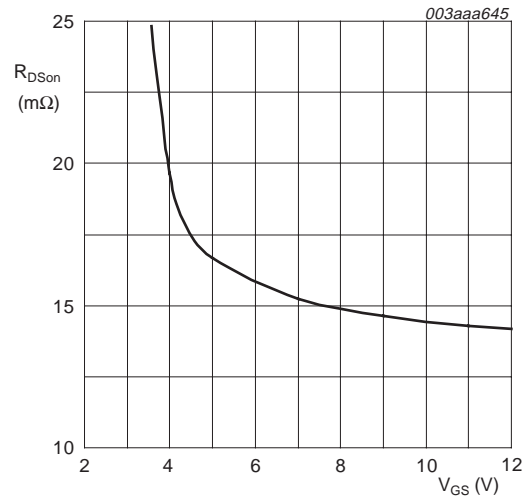
Table 5: Characteristics
T_j = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
V _{(BR)DSS}	drain-source breakdown voltage	I _D = 250 μA; V _{GS} = 0 V				
		T _j = 25 °C	55	-	-	V
		T _j = -55 °C	50	-	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 1 mA; V _{DS} = V _{GS} ; see Figure 9 and 10				
		T _j = 25 °C	1	1.5	2	V
		T _j = 175 °C	0.5	-	-	V
		T _j = -55 °C	-	-	2.3	V
I _{DSS}	drain leakage current	V _{DS} = 55 V; V _{GS} = 0 V				
		T _j = 25 °C	-	0.02	1	μA
		T _j = 175 °C	-	-	500	μA
I _{GSS}	gate leakage current	V _{GS} = ±15 V; V _{DS} = 0 V	-	2	100	nA
R _{DS(on)}	drain-source on-state resistance	V _{GS} = 5 V; I _D = 25 A; see Figure 6 and 8				
		T _j = 25 °C	-	16.3	19	mΩ
		T _j = 175 °C	-	-	40	mΩ
		V _{GS} = 4.5 V; I _D = 25 A; see Figure 6 and 8	-	-	21	mΩ
		V _{GS} = 10 V; I _D = 25 A; see Figure 6 and 8	-	14.3	17.3	mΩ
Dynamic characteristics						
Q _{G(tot)}	total gate charge	I _D = 25 A; V _{DD} = 44 V; V _{GS} = 5 V; see Figure 11	-	18	-	nC
Q _{GS}	gate-source charge		-	5	-	nC
Q _{GD}	gate-drain charge		-	8	-	nC
C _{iss}	input capacitance	V _{GS} = 0 V; V _{DS} = 25 V; f = 1 MHz; see Figure 14	-	1494	1992	pF
C _{oss}	output capacitance		-	217	260	pF
C _{rss}	reverse transfer capacitance		-	86	118	pF
t _{d(on)}	turn-on delay time	V _{DS} = 30 V; R _L = 1.2 Ω; V _{GS} = 5 V; R _G = 10 Ω	-	18	-	ns
t _r	rise time		-	180	-	ns
t _{d(off)}	turn-off delay time		-	44	-	ns
t _f	fall time		-	134	-	ns
Source-drain diode						
V _{SD}	source-drain voltage	I _S = 25 A; V _{GS} = 0 V; see Figure 13	-	0.85	1.2	V
t _{rr}	reverse recovery time	I _S = 20 A; dI _S /dt = -100 A/μs; V _{GS} = 0 V;	-	52	-	ns
Q _r	recovered charge	V _R = 30 V	-	38	-	nC



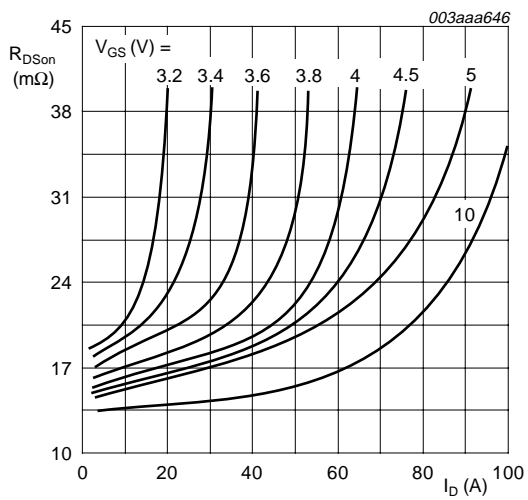
$T_j = 25\text{ }^\circ\text{C}$

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



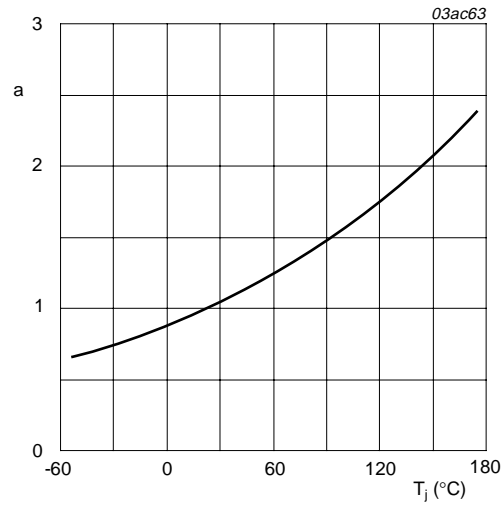
$T_j = 25\text{ }^\circ\text{C}$

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



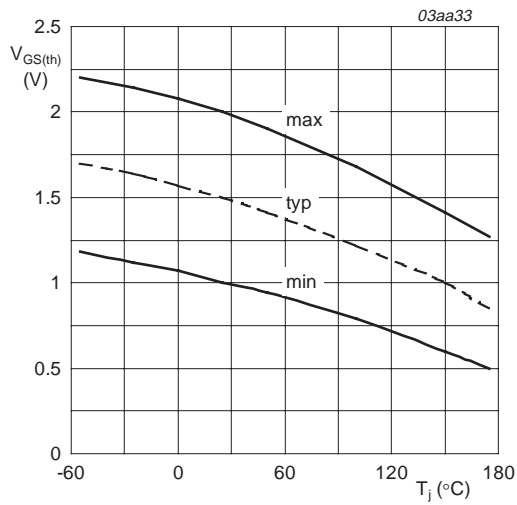
$T_j = 25\text{ }^\circ\text{C}$

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



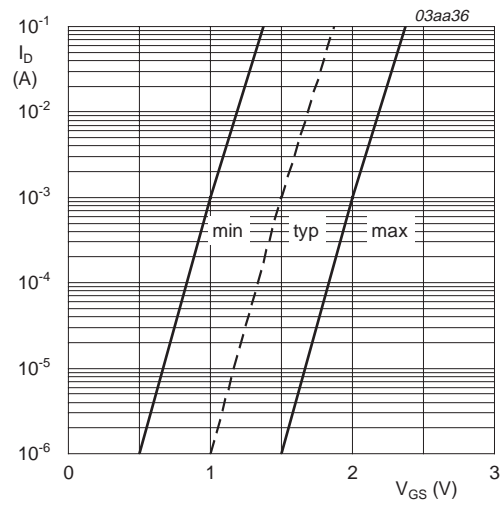
$$a = \frac{R_{DSon}}{R_{DSon}(25\text{ }^\circ\text{C})}$$

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



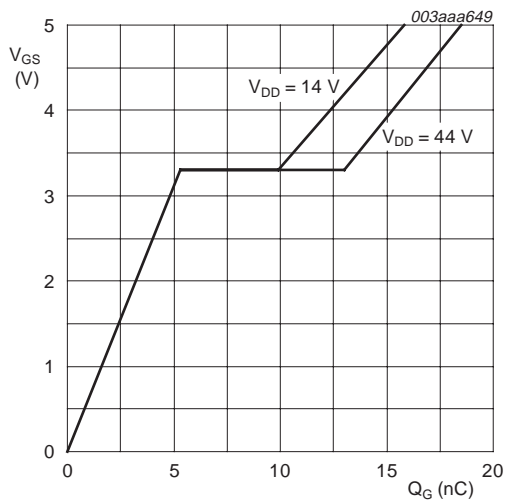
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

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



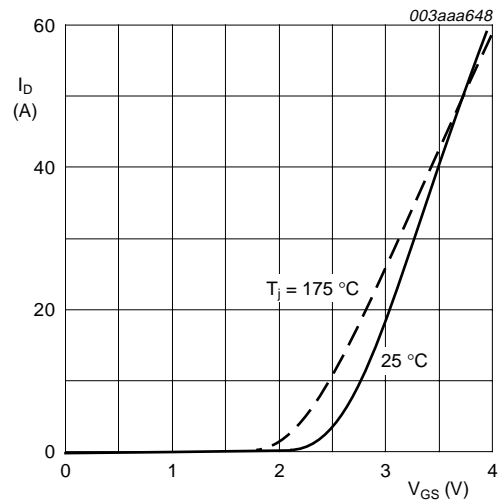
$T_j = 25 \text{ }^\circ\text{C}; V_{DS} = 5 \text{ V}$

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



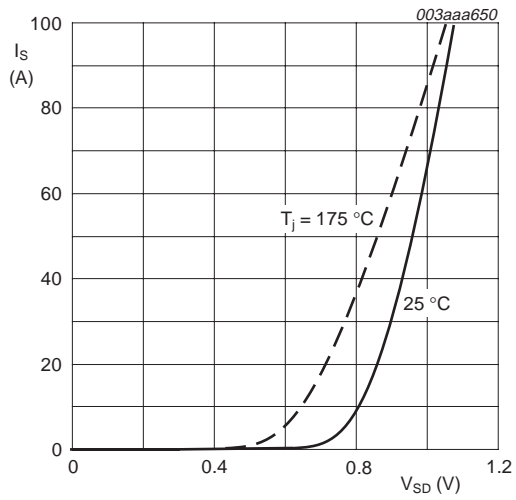
$I_D = 25 \text{ A}; V_{DD} = 14 \text{ V and } 44 \text{ V}$

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



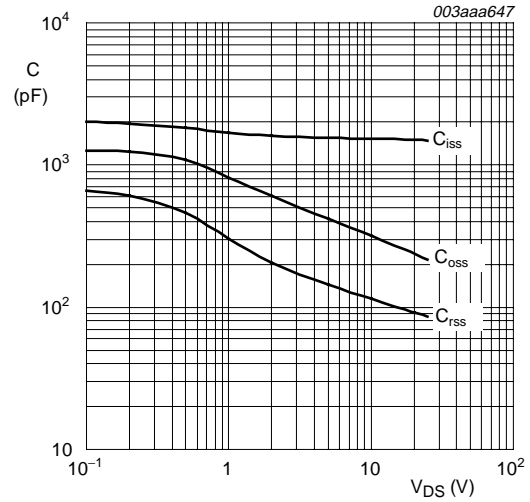
$T_j = 25 \text{ }^\circ\text{C and } 175 \text{ }^\circ\text{C}; V_{DS} > I_D \times R_{DS(on)}$

Fig 12. Transfer characteristics: drain current as a function of gate-source voltage; typical values



$T_j = 25\text{ °C}$ and 175 °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

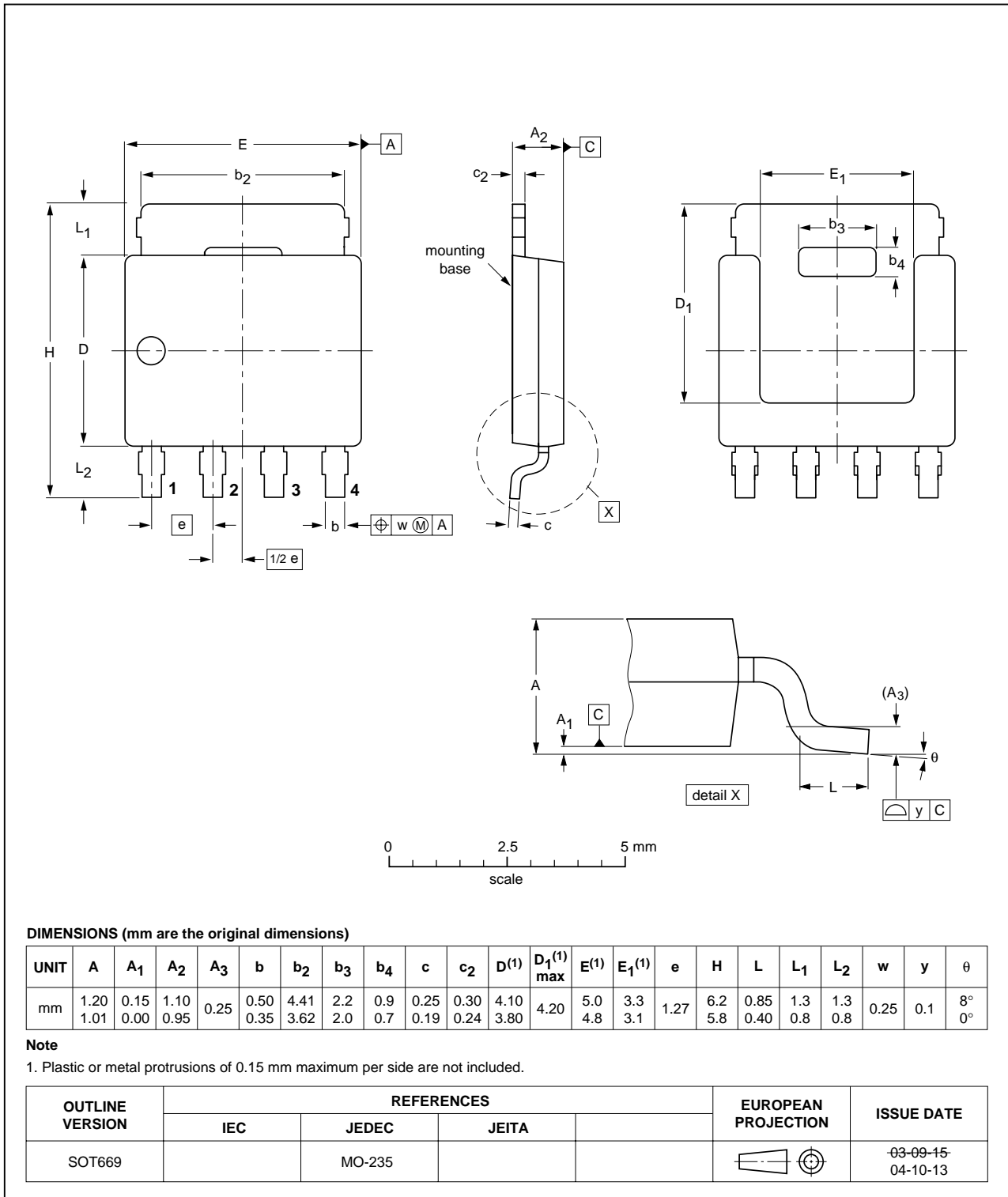


Fig 15. Package outline SOT669 (LPAK)

8. Revision history

Table 6: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
PH1955L_1	20050815	Product data sheet	-	-	-

9. Data sheet status

Level	Data sheet status ^[1]	Product status ^{[2] [3]}	Definition
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