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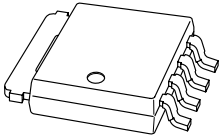
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Team Nexperia



PH5525L

N-channel TrenchMOS logic level FET

Rev. 02 — 5 December 2006

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
- Optimized for use in DC-to-DC converters
- 100 % R_G tested
- Lead-free package
- Very low switching and conduction losses

1.3 Applications

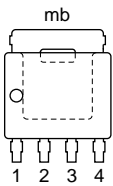
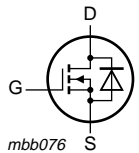
- DC-to-DC converters
- Voltage regulators
- Switched-mode power supplies
- PC Motherboards

1.4 Quick reference data

- V_{DS} ≤ 25 V
- R_{DSon} ≤ 5.5 mΩ
- I_D ≤ 81.7 A
- Q_{GD} = 3.3 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 (LFAK)

3. Ordering information

Table 2. Ordering information

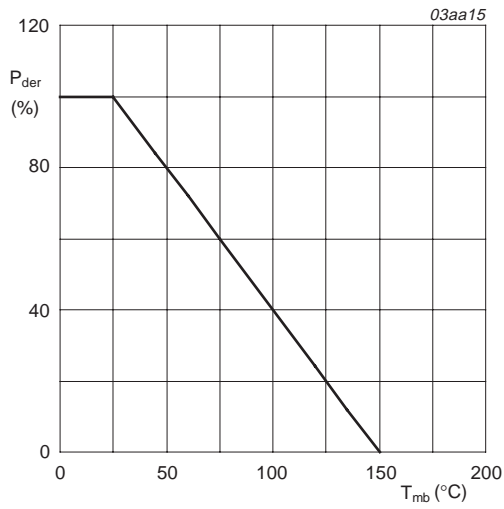
Type number	Package		Version
	Name	Description	
PH5525L	LFPK	plastic single-ended surface-mounted package; 4 leads	SOT669

4. Limiting values

Table 3. Limiting values

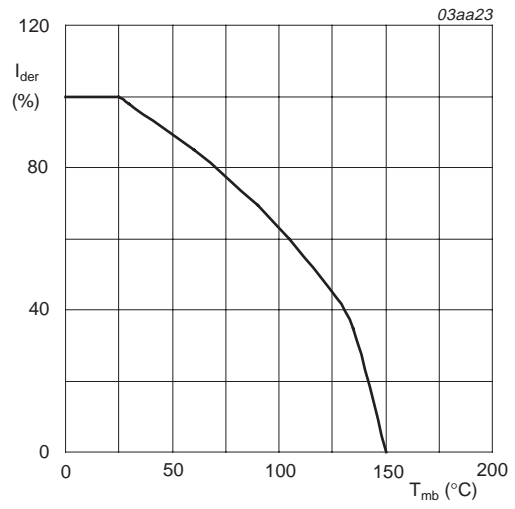
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$25\text{ °C} \leq T_j \leq 150\text{ °C}$	-	25	V
V_{DGR}	drain-gate voltage (DC)	$25\text{ °C} \leq T_j \leq 150\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	25	V
V_{GS}	gate-source voltage		-	± 20	V
I_D	drain current	$T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; see Figure 2 and 3	-	81.7	A
		$T_{mb} = 100\text{ °C}$; $V_{GS} = 10\text{ V}$; see Figure 2	-	51.7	A
I_{DM}	peak drain current	$T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$; see Figure 3	-	300	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	$T_{mb} = 25\text{ °C}$	-	52	A
I_{SM}	peak source current	$T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$	-	208	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	unclamped inductive load; $I_D = 45\text{ A}$; $t_p = 0.1\text{ ms}$; $V_{DS} \leq 25\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 10\text{ V}$; starting at $T_j = 25\text{ °C}$	-	100	mJ



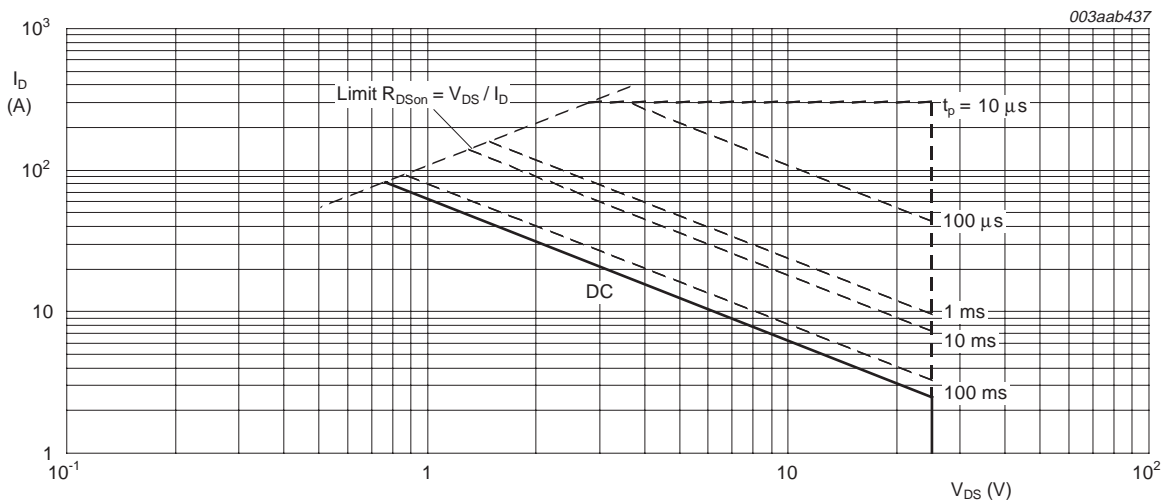
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100 \%$$

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



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

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



T_{mb} = 25 °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

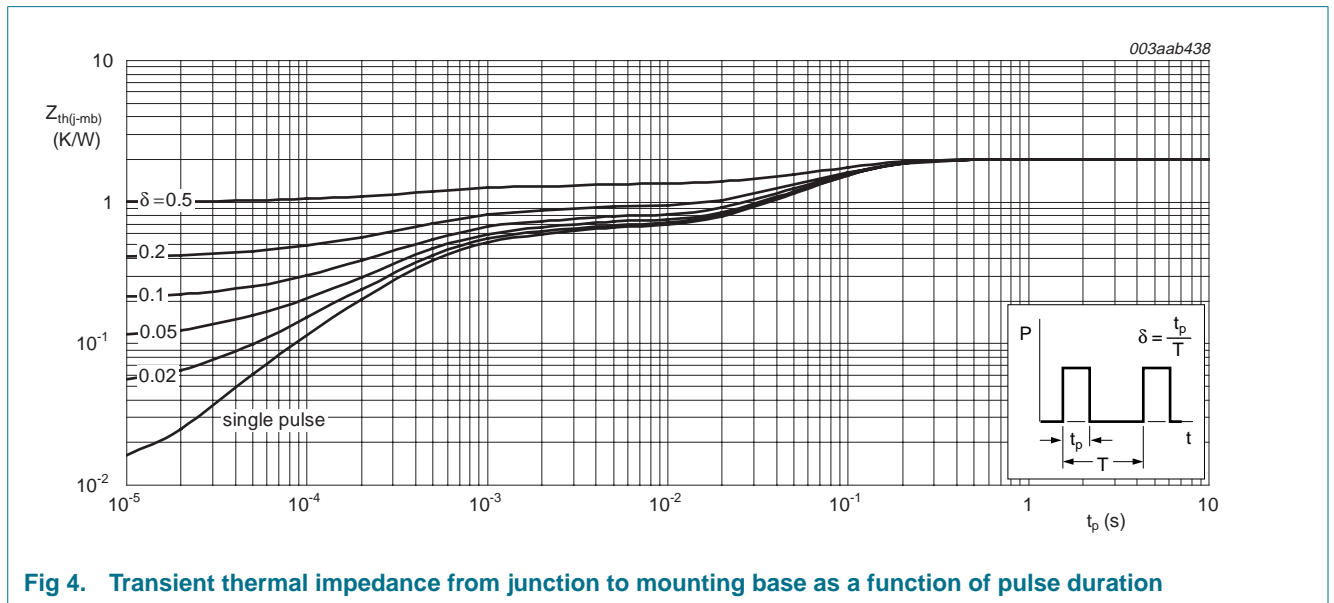


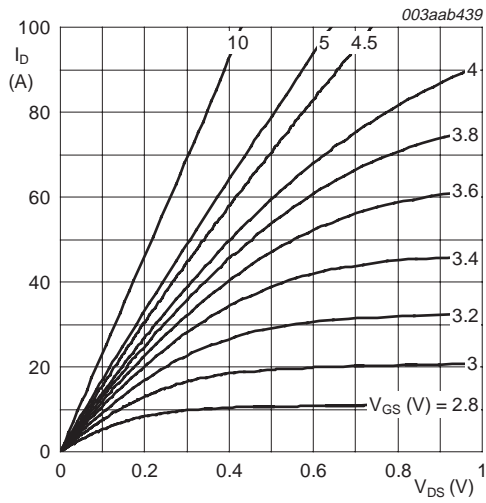
Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

Table 5. Characteristics

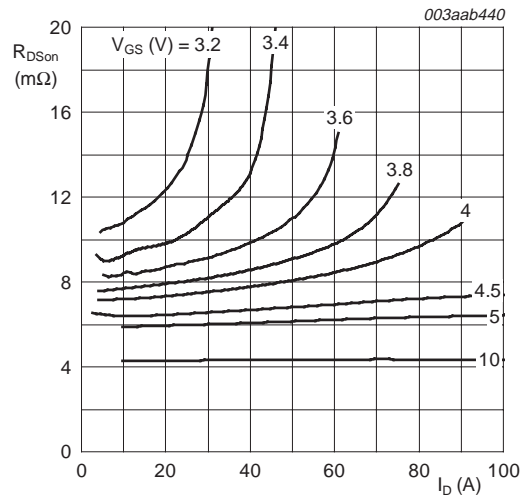
$T_j = 25\text{ °C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$ $T_j = 25\text{ °C}$	25	-	-	V
		$T_j = -55\text{ °C}$	22.5	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; see Figure 9 and 10 $T_j = 25\text{ °C}$	1.3	1.7	2.15	V
		$T_j = 150\text{ °C}$	0.8	-	-	V
		$T_j = -55\text{ °C}$	-	-	2.6	V
I_{DSS}	drain leakage current	$V_{DS} = 25\ \text{V}$; $V_{GS} = 0\ \text{V}$ $T_j = 25\text{ °C}$	-	-	1	μA
		$T_j = 150\text{ °C}$	-	-	100	μA
I_{GSS}	gate leakage current	$V_{GS} = \pm 16\ \text{V}$; $V_{DS} = 0\ \text{V}$	-	-	100	nA
R_G	gate resistance	$f = 1\ \text{MHz}$	-	1.8	-	Ω
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\ \text{V}$; $I_D = 25\ \text{A}$; see Figure 6 and 8 $T_j = 25\text{ °C}$	-	4	5.5	m Ω
		$T_j = 150\text{ °C}$	-	6.8	9.35	m Ω
		$V_{GS} = 4.5\ \text{V}$; $I_D = 25\ \text{A}$; see Figure 6 and 8	-	5.9	8.2	m 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 11 and 12	-	16.6	-	nC
Q_{GS}	gate-source charge		-	8	-	nC
Q_{GS1}	pre- $V_{GS(th)}$ gate-source charge		-	3.4	-	nC
Q_{GS2}	post- $V_{GS(th)}$ gate-source charge		-	4.6	-	nC
Q_{GD}	gate-drain charge		-	3.3	-	nC
$V_{GS(pl)}$	gate-source plateau voltage		-	3.1	-	V
C_{iss}	input capacitance	$V_{GS} = 0\ \text{V}$; $V_{DS} = 12\ \text{V}$; $f = 1\ \text{MHz}$; see Figure 14	-	2150	-	pF
C_{oss}	output capacitance		-	500	-	pF
C_{rss}	reverse transfer capacitance		-	225	-	pF
C_{iss}	input capacitance	$V_{GS} = 0\ \text{V}$; $V_{DS} = 0\ \text{V}$; $f = 1\ \text{MHz}$	-	2460	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 12\ \text{V}$; $R_L = 0.5\ \Omega$; $V_{GS} = 4.5\ \text{V}$; $R_G = 5.6\ \Omega$	-	25	-	ns
t_r	rise time		-	55	-	ns
$t_{d(off)}$	turn-off delay time		-	28	-	ns
t_f	fall time		-	17	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 25\ \text{A}$; $V_{GS} = 0\ \text{V}$; see Figure 13	-	0.83	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\ \text{A}$; $dI_S/dt = -100\ \text{A}/\mu\text{s}$; $V_{GS} = 0\ \text{V}$	-	33.2	-	ns
Q_r	recovered charge		-	10.8	-	nC



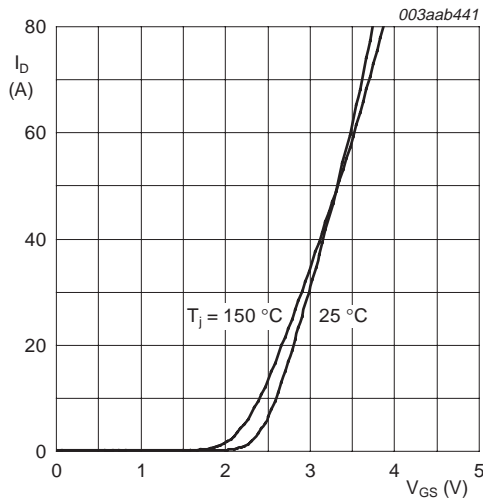
$T_j = 25\text{ }^\circ\text{C}$

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



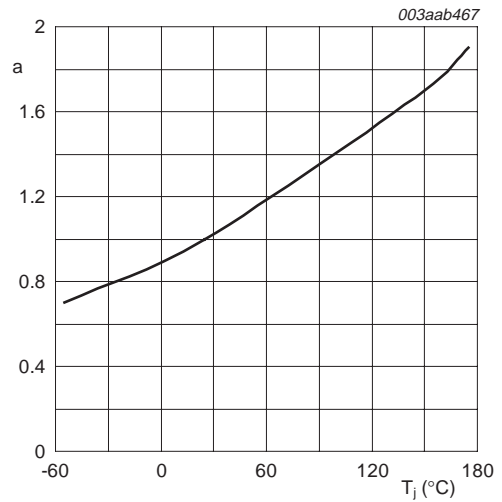
$T_j = 25\text{ }^\circ\text{C}$

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



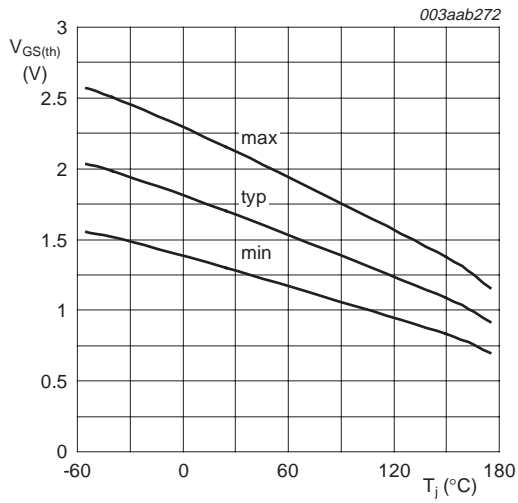
$T_j = 25\text{ }^\circ\text{C}$ and $150\text{ }^\circ\text{C}$; $V_{DS} > I_D \times R_{DS(on)}$

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



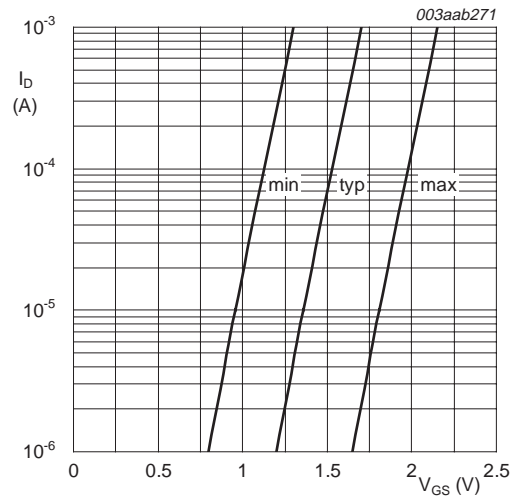
$$a = \frac{R_{DS(on)}}{R_{DS(on)(25^\circ\text{C})}}$$

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



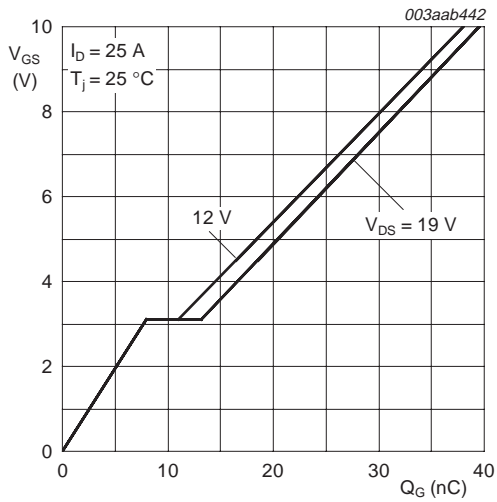
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

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



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

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



$I_D = 25 \text{ A}; V_{DS} = 12 \text{ V and } 19 \text{ V}$

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

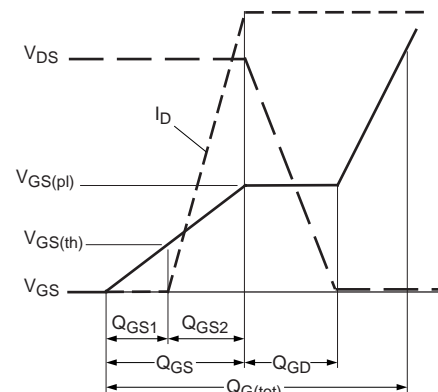
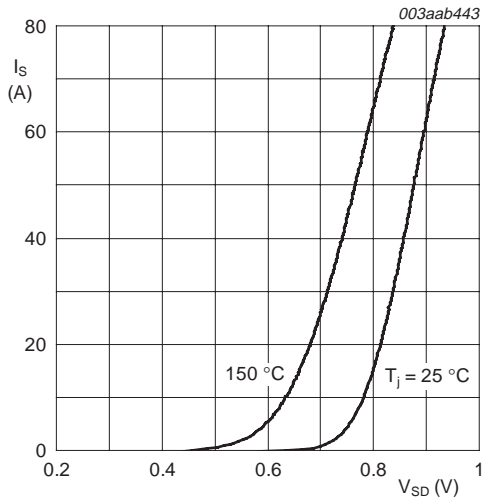
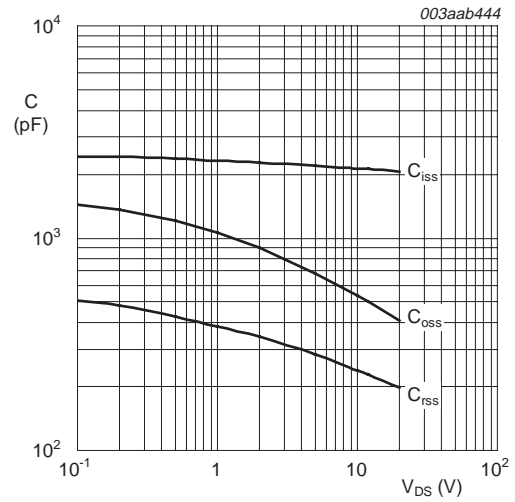


Fig 12. Gate charge waveform definitions



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

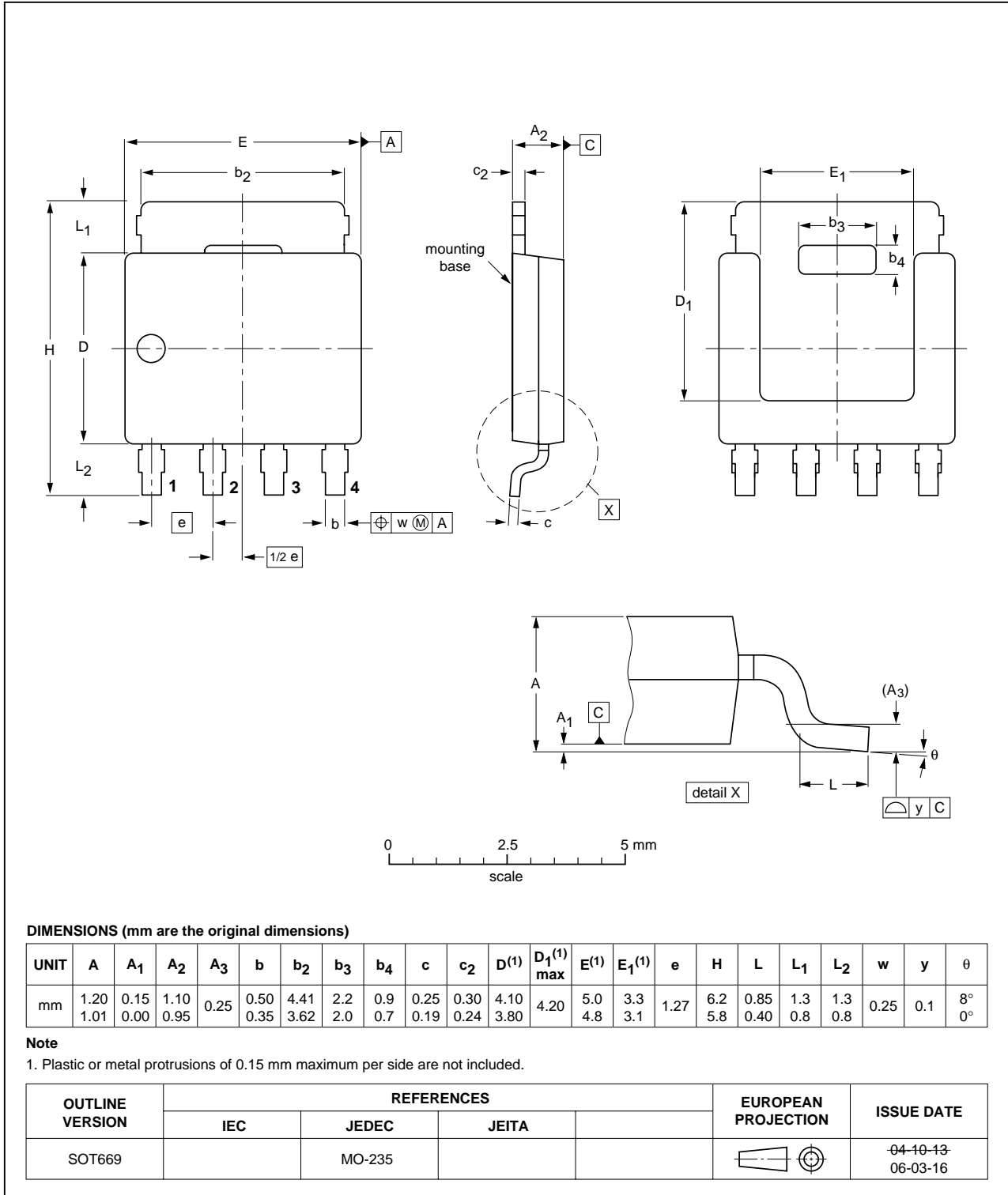


Fig 15. Package outline SOT669 (LPAK)

8. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PH5525L_2	20061205	Product data sheet	-	PH5525L_1
Modifications:	• Section 1.2 : updated the list			
PH5525L_1	20061010	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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11. Contents

1	Product profile	1
1.1	General description	1
1.2	Features	1
1.3	Applications	1
1.4	Quick reference data	1
2	Pinning information	1
3	Ordering information	2
4	Limiting values	2
5	Thermal characteristics	4
6	Characteristics	5
7	Package outline	9
8	Revision history	10
9	Legal information	11
9.1	Data sheet status	11
9.2	Definitions	11
9.3	Disclaimers	11
9.4	Trademarks	11
10	Contact information	11
11	Contents	12

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