

PHM12NQ20T

TrenchMOS™ standard level FET

Rev. 01 — 30 January 2003

Preliminary data

1. Product profile

1.1 Description

N-channel enhancement mode field-effect transistor in a plastic package using TrenchMOS™ technology.

Product availability:

PHM12NQ20T in SOT685-1 (QLPAK).

1.2 Features

- SOT96 (SO-8) footprint compatible
- Low thermal resistance
- Surface mount package
- Low profile.

1.3 Applications

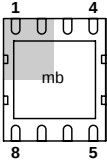
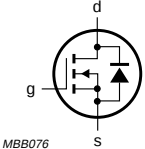
- DC-DC converter primary side switch
- Portable equipment applications.

1.4 Quick reference data

- $V_{DS} \leq 200 \text{ V}$
- $I_D \leq 14.4 \text{ A}$
- $P_{tot} \leq 62.5 \text{ W}$
- $R_{DSon} \leq 130 \text{ m}\Omega$.

2. Pinning information

Table 1: Pinning - SOT685 (QLPAK), simplified outlines and symbol

Pin	Description	Simplified outline	Symbol
1,2,3	source (s)		
4	gate (g)		
5,6,7,8	drain (d)		
mb	mounting base, connected to drain (d)		

SOT685-1 (QLPAK)

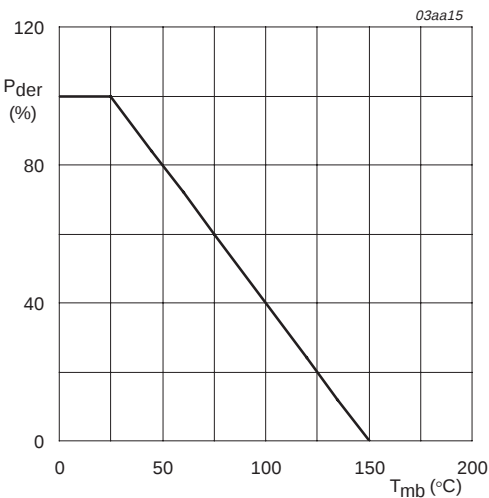
[1] Shaded area indicates pin 1 identifier

3. Limiting values

Table 2: Limiting values

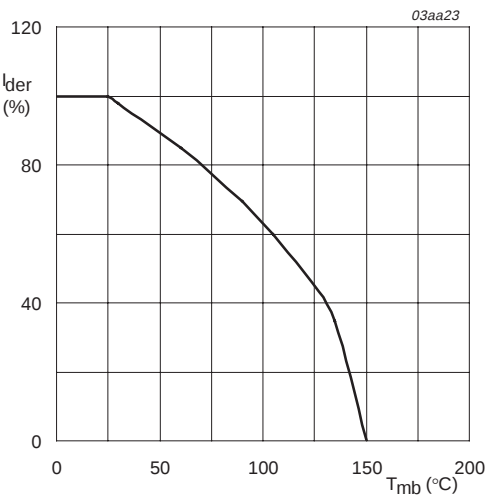
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage (DC)	$25\text{ °C} \leq T_j \leq 150\text{ °C}$	-	200	V
V_{DGR}	drain-gate voltage (DC)	$25\text{ °C} \leq T_j \leq 150\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	200	V
V_{GS}	gate-source voltage (DC)		-	± 20	V
I_D	drain current (DC)	$T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; Figure 2 and 3	-	14.4	A
		$T_{mb} = 100\text{ °C}$; $V_{GS} = 10\text{ V}$; Figure 2	-	5.8	A
I_{DM}	peak drain current	$T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$; Figure 3	-	56.8	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; 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 (diode forward) current (DC)	$T_{mb} = 25\text{ °C}$	-	14.4	A
I_{SM}	peak source (diode forward) current	$T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$	-	56	A



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

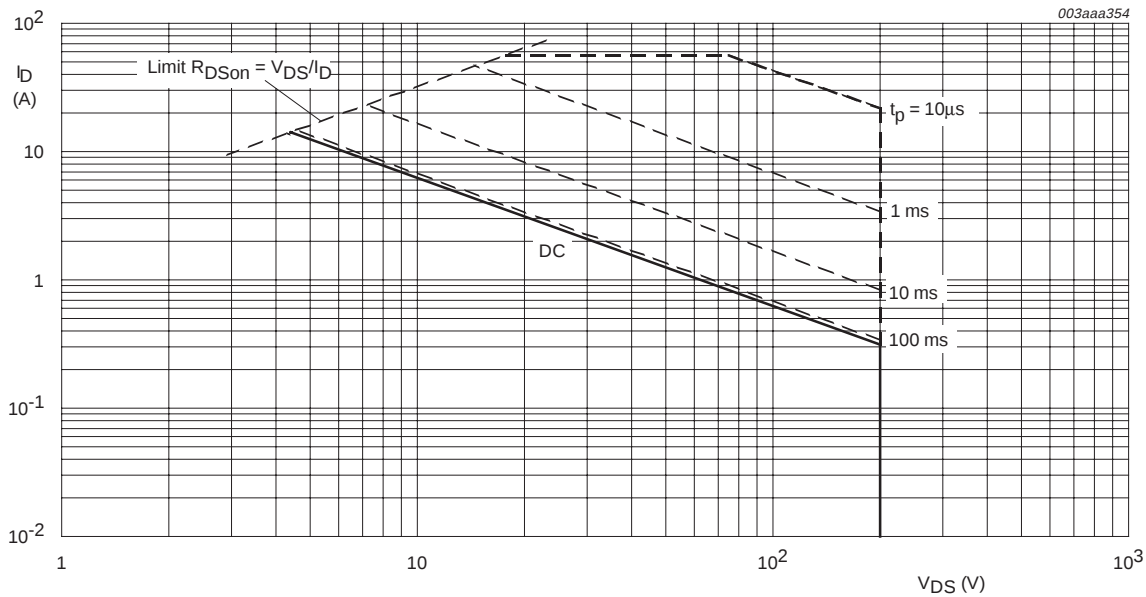
Fig 1. Normalized total power dissipation as a function of mounting base temperature.



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

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

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



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

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

4. Thermal characteristics

Table 3: Thermal characteristics

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

4.1 Transient thermal impedance

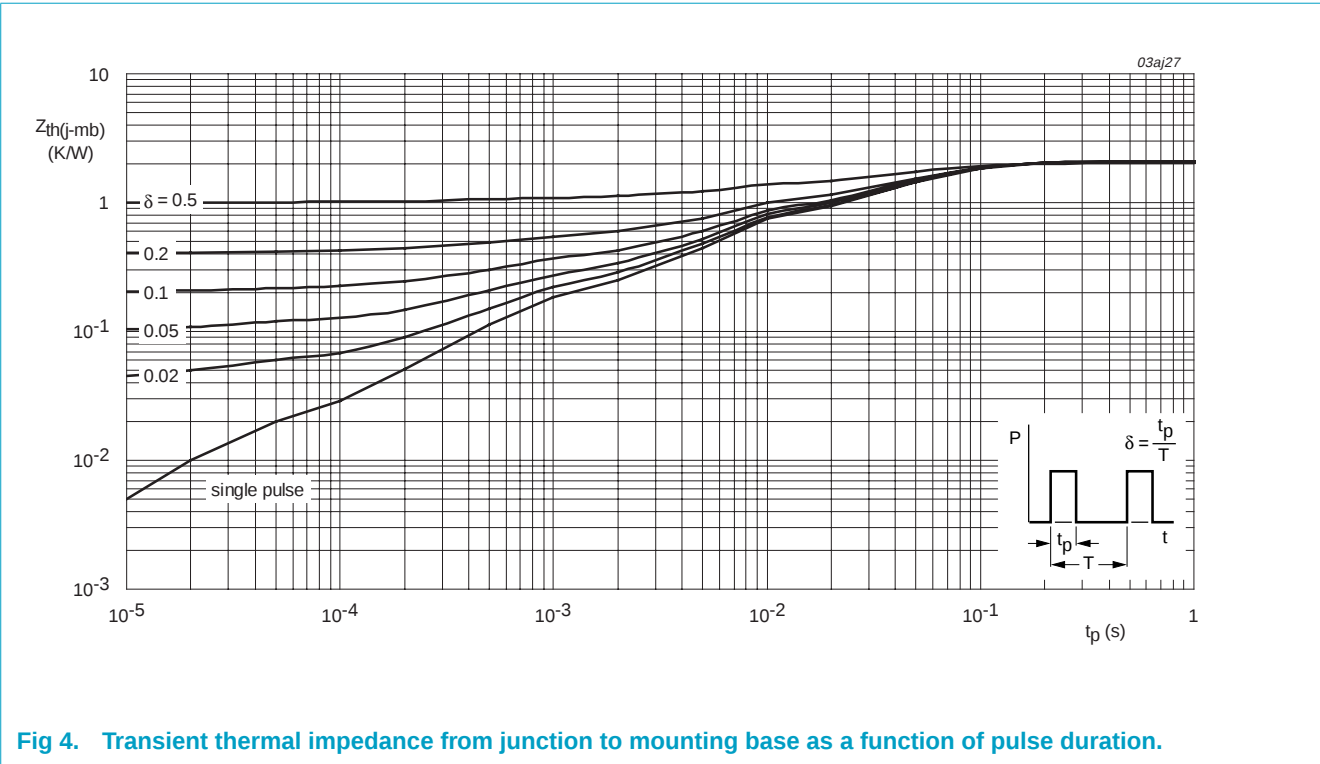


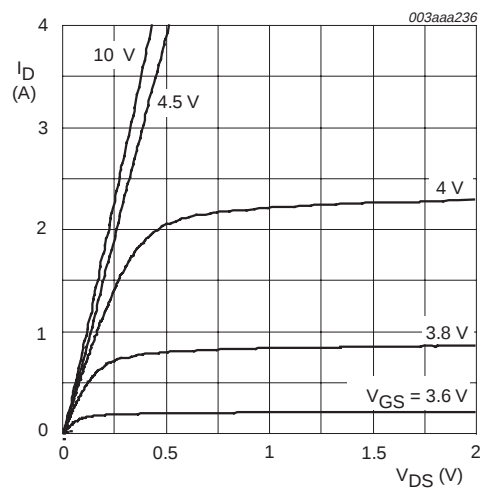
Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration.

5. Characteristics

Table 4: Characteristics

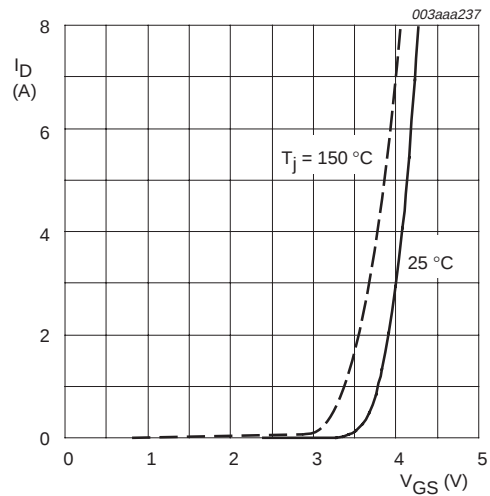
$T_j = 25\text{ °C}$ unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\text{ }\mu\text{A}$; $V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ °C}$	200	-	-	V
		$T_j = -55\text{ °C}$	178	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$; Figure 9				
		$T_j = 25\text{ °C}$	2	3	4	V
		$T_j = 150\text{ °C}$	1.2	-	-	V
		$T_j = -55\text{ °C}$	-	-	6	V
I_{DSS}	drain-source leakage current	$V_{DS} = 160\text{ V}$; $V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ °C}$	-	-	1	μA
		$T_j = 150\text{ °C}$	-	-	100	μA
I_{GSS}	gate-source leakage current	$V_{GS} = \pm 10\text{ V}$; $V_{DS} = 0\text{ V}$	-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 12\text{ A}$; Figure 7 and 8				
		$T_j = 25\text{ °C}$	-	108	130	m Ω
		$T_j = 150\text{ °C}$	-	260	312	m Ω
		$V_{GS} = 5\text{ V}$; $I_D = 3\text{ A}$	-	110	150	m Ω
Dynamic characteristics						
$Q_{g(tot)}$	total gate charge	$I_D = 4\text{ A}$; $V_{DD} = 100\text{ V}$; $V_{GS} = 10\text{ V}$; Figure 13	-	26	-	nC
Q_{gs}	gate-source charge		-	4	-	nC
Q_{gd}	gate-drain (Miller) charge		-	8.7	-	nC
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 25\text{ V}$; $f = 1\text{ MHz}$; Figure 12	-	1230	-	pF
C_{oss}	output capacitance		-	155	-	pF
C_{rss}	reverse transfer capacitance		-	48	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DD} = 100\text{ V}$; $I_D = 4\text{ A}$; $V_{GS} = 10\text{ V}$; $R_G = 6\text{ }\Omega$	-	12.5	-	ns
t_r	rise time		-	10.2	-	ns
$t_{d(off)}$	turn-off delay time		-	34.5	-	ns
t_f	fall time		-	13.5	-	ns
Source-drain diode						
V_{SD}	source-drain (diode forward) voltage	$I_S = 4\text{ A}$; $V_{GS} = 0\text{ V}$; Figure 11	-	0.71	1.2	V
t_{rr}	reverse recovery time	$I_S = 4\text{ A}$; $di_S/dt = -100\text{ A}/\mu\text{s}$; $V_R = 120\text{ V}$;	-	104	-	ns
Q_r	recovered charge	$V_{GS} = 0\text{ V}$	-	245	-	nC



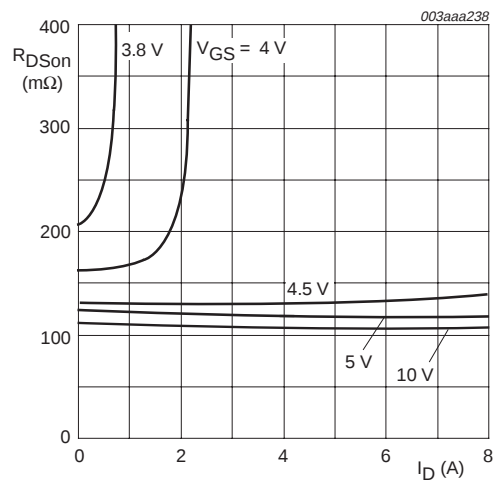
$T_j = 25\text{ }^{\circ}\text{C}$

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



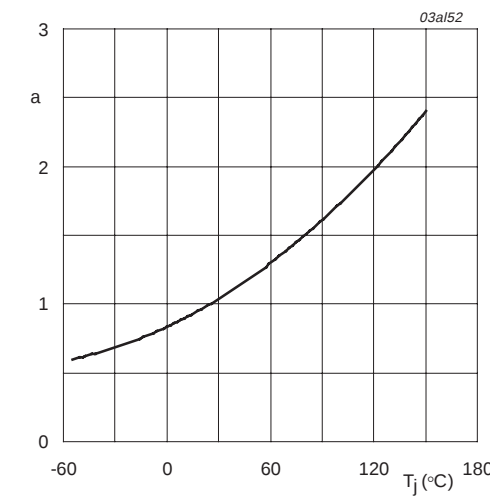
$T_j = 25\text{ }^{\circ}\text{C}$ and $150\text{ }^{\circ}\text{C}$; $V_{DS} > I_D \times R_{DSon}$

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



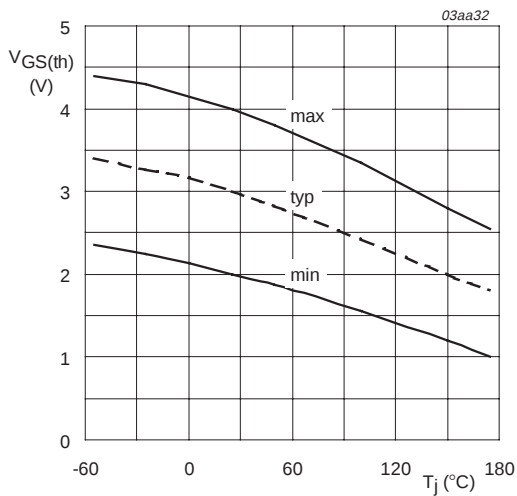
$T_j = 25\text{ }^{\circ}\text{C}$

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



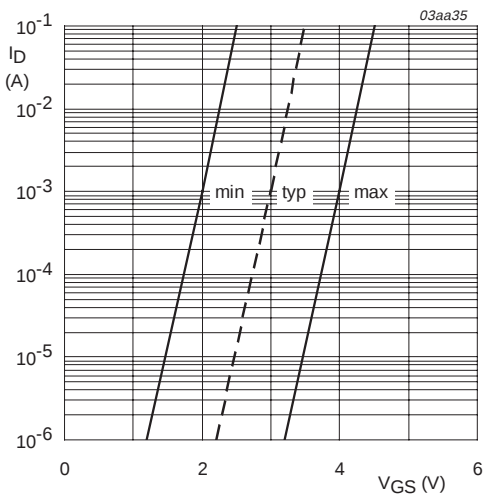
$$a = \frac{R_{DSon}}{R_{DSon(25^{\circ}\text{C})}}$$

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



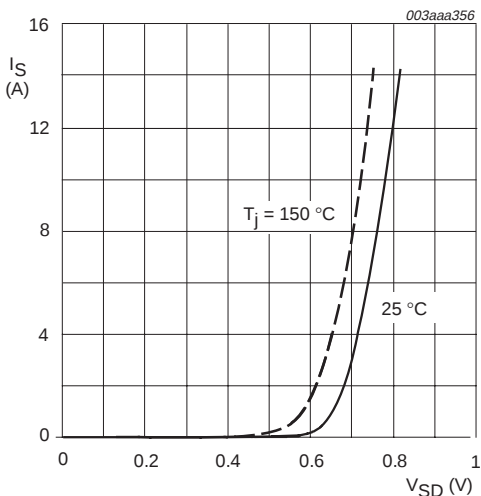
$I_D = 1 \text{ mA}$; $V_{DS} = V_{GS}$

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



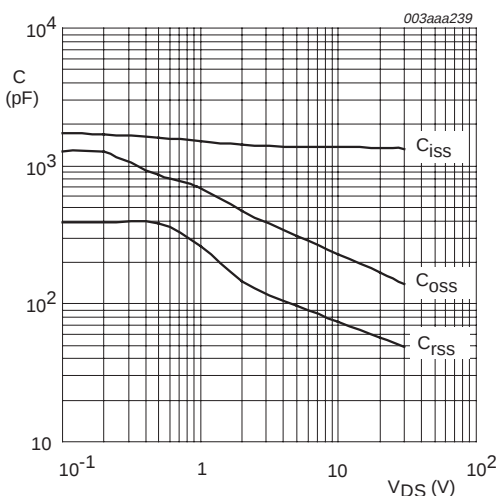
$T_j = 25 \text{ °C}$; $V_{DS} = 5 \text{ V}$

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



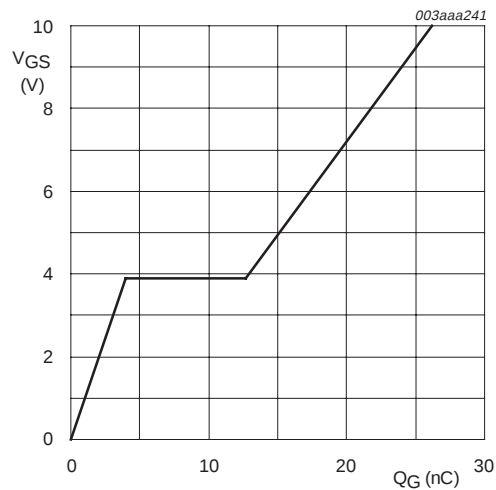
$T_j = 25 \text{ °C}$ and 150 °C ; $V_{GS} = 0 \text{ V}$

Fig 11. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values.



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

Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values.



$I_D = 4\text{ A}; V_{DD} = 100\text{ V}$

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

6. Package outline

HVSON8: plastic thermal enhanced very thin small outline package; no leads;
8 terminals; body 6 x 5 x 0.85 mm

SOT685-1

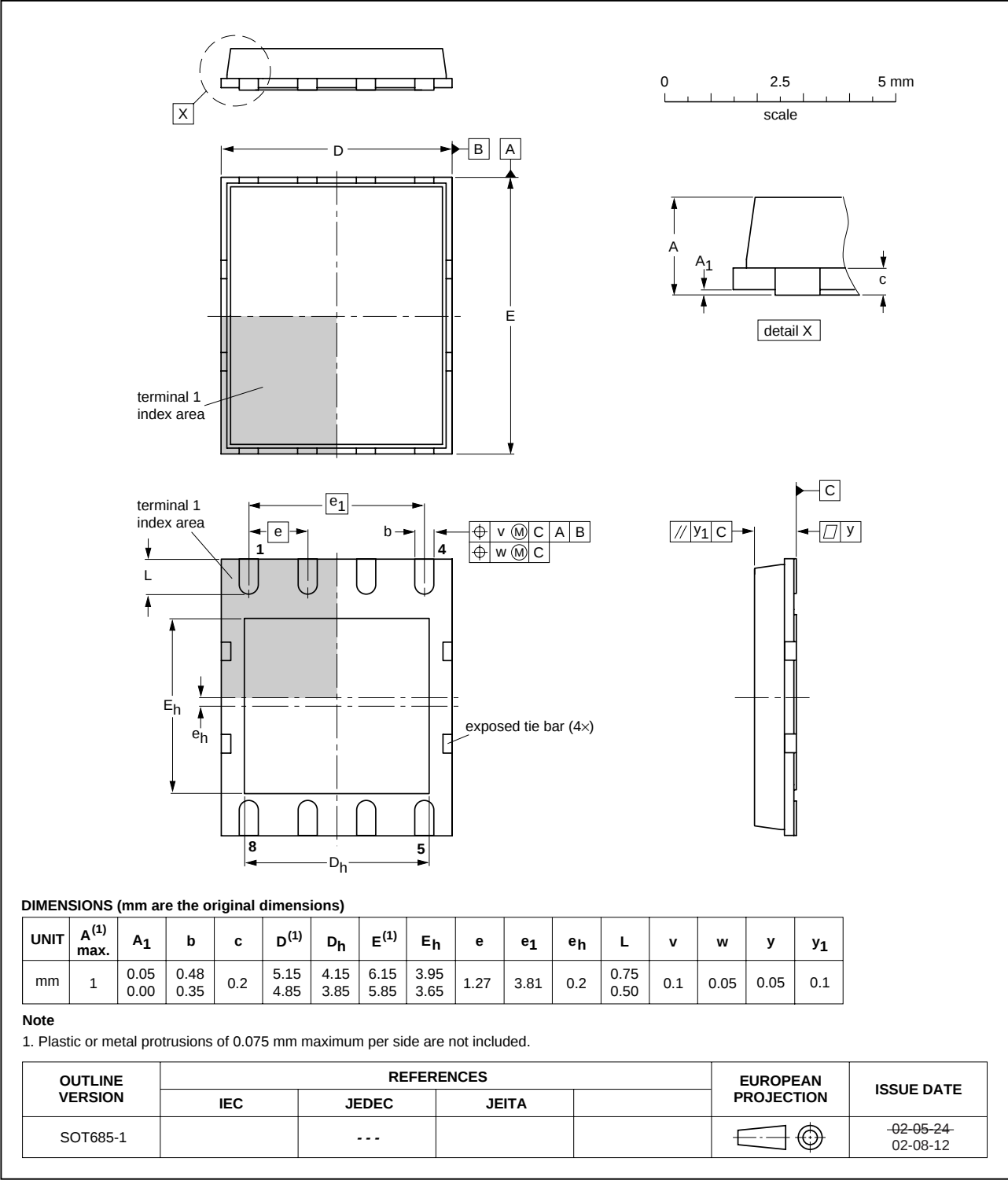


Fig 14. SOT685-1 (QLPAK).

7. Revision history

Table 5: Revision history

Rev	Date	CPCN	Description
01	20030130	-	Preliminary data (9397 750 10876)

8. 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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Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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