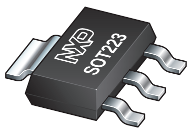


PHT4NQ10LT

N-channel TrenchMOS logic level FET

Rev. 2 — 28 October 2011 **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. This product is designed and qualified for use in computing, communications, consumer and industrial applications.

1.2 Features and benefits

- Low conduction losses due to low on-state resistance
- Logic level compatible

1.3 Applications

- DC-to-DC converters
- General purpose switching
- High-speed line drivers

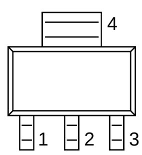
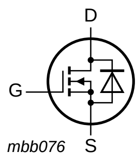
1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 150$ °C	-	-	100	V
I_D	drain current	$T_{sp} = 25$ °C; $V_{GS} = 5$ V; see Figure 1; see Figure 2	-	-	3.5	A
V_{GS}	gate-source voltage		-16	-	16	V
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = 5$ V; $I_D = 1.75$ A; $T_j = 25$ °C; see Figure 10; see Figure 11	-	200	250	mΩ

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 SOT223 (SC-73)	
2	D	drain		
3	S	source		
4	D	drain		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PHT4NQ10LT	SC-73	plastic surface-mounted package with increased heatsink; 4 leads	SOT223

4. Marking

Table 4. Marking codes

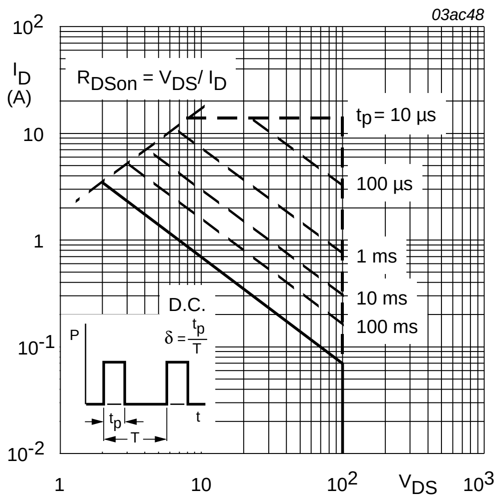
Type number	Marking code
PHT4NQ10LT	4NQ10L

5. Limiting values

Table 5. Limiting values

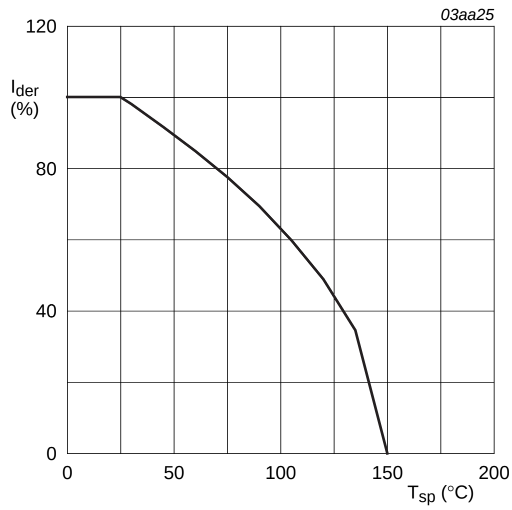
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25$ °C; $T_j \leq 150$ °C	-	100	V
V_{DGR}	drain-gate voltage	$T_j \geq 25$ °C; $T_j \leq 150$ °C; $R_{GS} = 20$ kΩ	-	100	V
V_{GS}	gate-source voltage		-16	16	V
I_D	drain current	$T_{sp} = 100$ °C; $V_{GS} = 5$ V	-	2.2	A
		$T_{sp} = 25$ °C; $V_{GS} = 5$ V; see Figure 1; see Figure 2	-	3.5	A
I_{DM}	peak drain current	$T_{sp} = 25$ °C; pulsed; $t_p \leq 10$ µs; see Figure 1	-	14	A
P_{tot}	total power dissipation	$T_{sp} = 25$ °C; see Figure 3	-	6.9	W
T_{stg}	storage temperature		-65	150	°C
T_j	junction temperature		-65	150	°C
Source-drain diode					
I_S	source current	$T_{sp} = 25$ °C	-	3.5	A
I_{SM}	peak source current	$T_{sp} = 25$ °C; pulsed; $t_p \leq 10$ µs	-	14	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 5$ V; $T_j = 25$ °C; $I_D = 3.5$ A; $R_{GS} = 50$ Ω; $V_{sup} \leq 15$ V; unclamped; $t_p = 0.2$ ms; see Figure 4	-	45	mJ
I_{AS}	non-repetitive avalanche current	$V_{sup} \leq 15$ V; $V_{GS} = 5$ V; $T_{j(init)} = 25$ °C; $R_{GS} = 50$ Ω; unclamped; see Figure 4	-	3.5	A



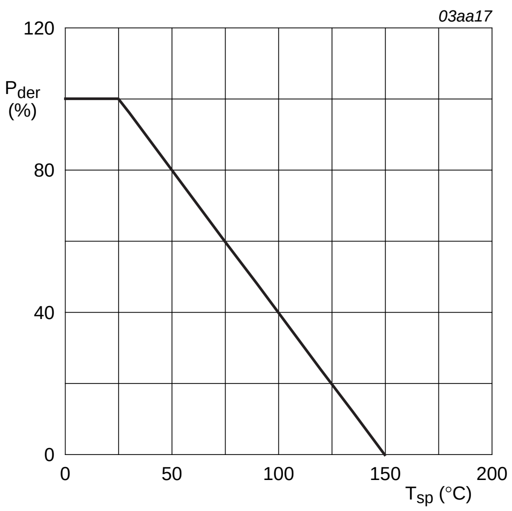
$T_{sp} = 25°C; I_{DM}$ is single pulse;

Fig 1. Safe operating area; continuous and peak drain currents as a function of drain-source voltage



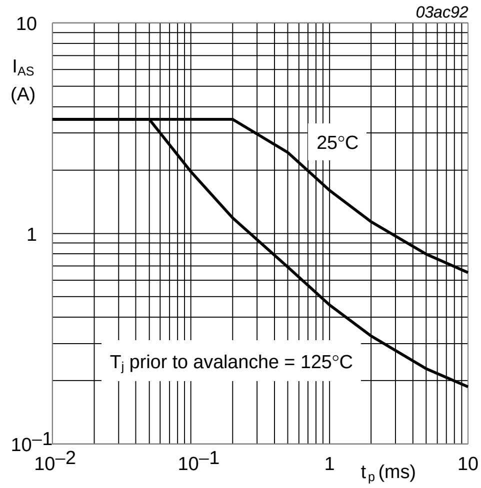
$$I_{der} = \frac{I_D}{I_{D(25°C)}} \times 100\,\%$$

Fig 2. Normalized continuous drain current as a function of solder point temperature



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

Fig 3. Normalized total power dissipation as a function of solder point temperature



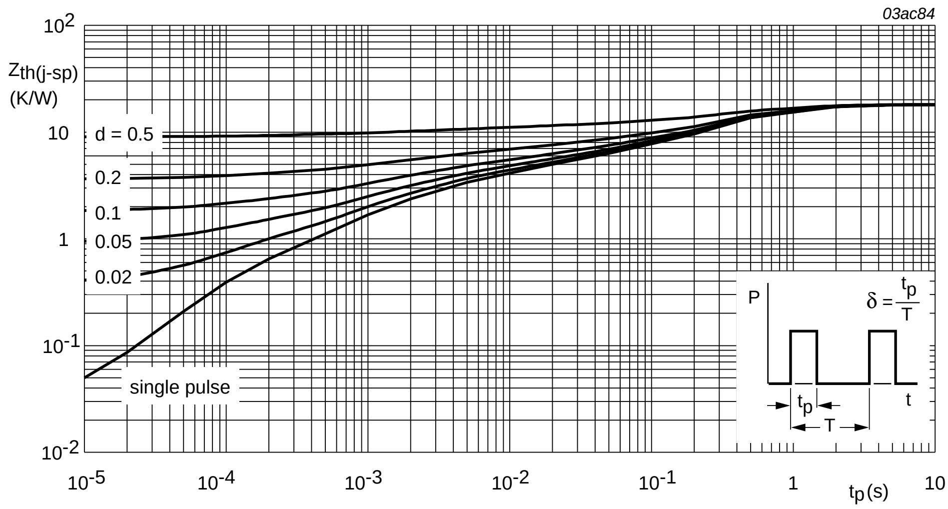
Unclamped inductive load; $V_{DD} \leq 15$ V;
$R_{GS} = 50\ \Omega$; $V_{GS} = 5$ V; starting $T_j = 25$ °C and 125 °C.

Fig 4. Non-repetitive avalnche ruggednes current as a function of pulse duration

6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point	mounted on a metal clad substrate	-	-	18	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	mounted on a printed-circuit board ; minimum footprint	-	-	150	K/W



T_{sp} = 25 °C

Fig 5. Transient thermal impedance from junction to solder point as a function of pulse duration

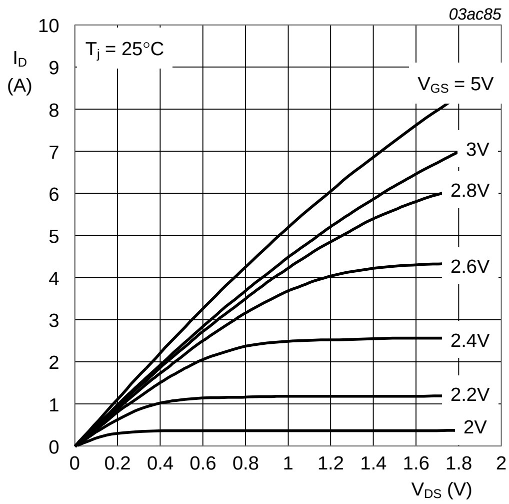
7. Characteristics

Table 7. Characteristics

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 = -55 °C	89	-	-	V
		I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C	100	130	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 1 mA; V_{DS} = V_{GS}; T_j = 150 °C; see Figure 9	0.6	-	-	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = -55 °C; see Figure 9	-	-	2.3	V
		I_D = 1 mA; V_{DS} = V_{GS}; T_j = 25 °C; see Figure 9	1	-	2	V
I_{GSS}	gate leakage current	V_{GS} = -10 V; V_{DS} = 0 V; T_j = 25 °C	-	10	100	nA
		V_{GS} = 10 V; V_{DS} = 0 V; T_j = 25 °C	-	10	100	nA

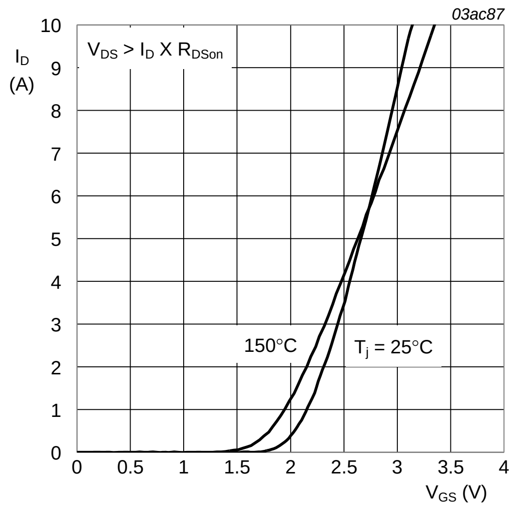
Table 7. Characteristics *...continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R_{DSon}	drain-source on-state resistance	V_{GS} = 5 V; I_D = 1.75 A; T_j = 150 °C; see Figure 10; see Figure 11	-	-	575	mΩ
		V_{GS} = 5 V; I_D = 1.75 A; T_j = 25 °C; see Figure 10; see Figure 11	-	200	250	mΩ
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = 3.5 A; V_{DS} = 80 V; V_{GS} = 5 V; T_j = 25 °C; see Figure 12	-	6.8	-	nC
Q_{GS}	gate-source charge		-	1.1	-	nC
Q_{GD}	gate-drain charge		-	3.6	-	nC
$t_{d(on)}$	turn-on delay time	V_{DS} = 50 V; R_L = 15 Ω; V_{GS} = 5 V; $R_{G(ext)}$ = 6 Ω; T_j = 25 °C	-	4	-	ns
t_r	rise time		-	10	-	ns
$t_{d(off)}$	turn-off delay time		-	52	-	ns
t_f	fall time		-	21	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	I_S = 3.5 A; V_{GS} = 0 V; T_j = 25 °C; see Figure 13	-	0.87	1.5	V
t_{rr}	reverse recovery time	I_S = 3.5 A; dI_S/dt = -100 A/µs; V_{GS} = 0 V; V_{DS} = 30 V; T_j = 25 °C	-	50	-	ns
Q_r	recovered charge		-	100	-	nC



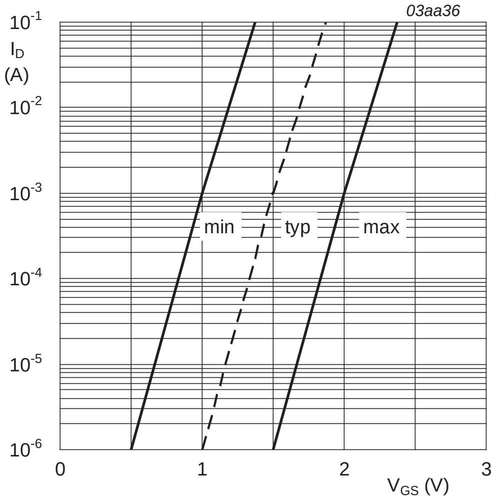
$T_j = 25°C$

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



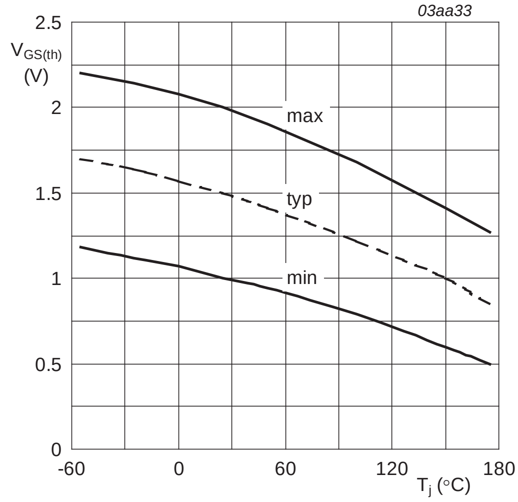
$T_j = 25°C$ and $150°C$; $V_{DS} > I_D \times R_{DSon}$

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



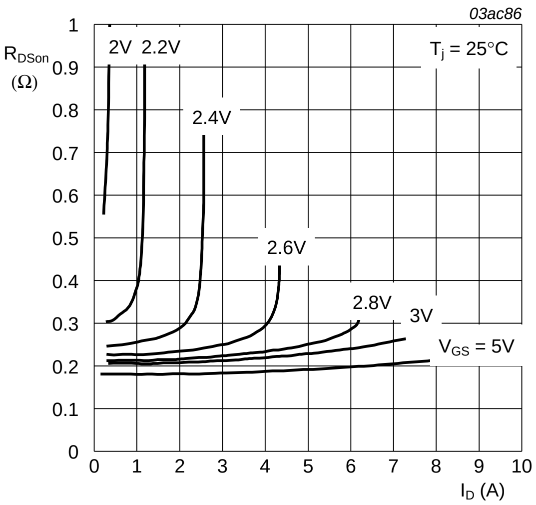
T_j = 25 °C; V_{DS} = 5 V

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



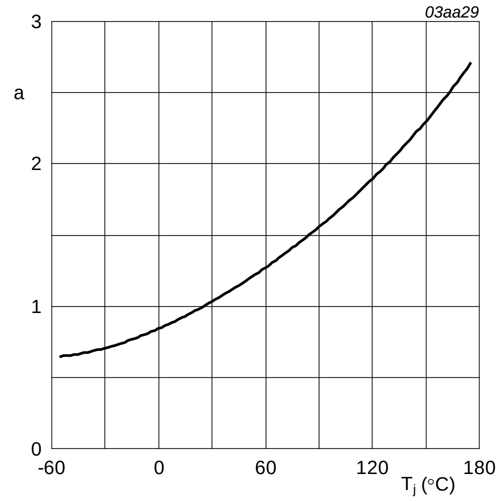
$$I_D = 1mA; V_{DS} = V_{GS}$$

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



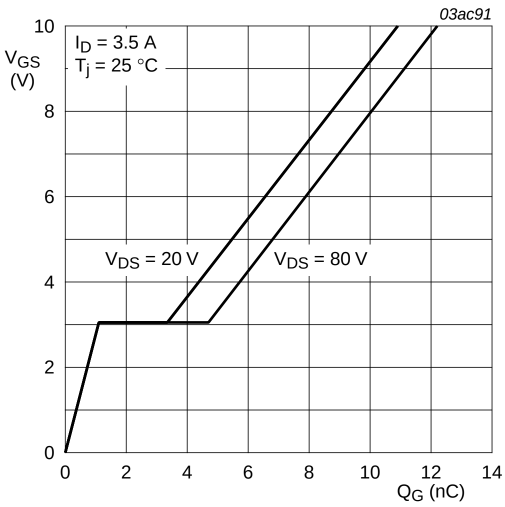
$$T_j = 25°C$$

Fig 10. Drain-source on-state resistance as a function of drain current; typical values



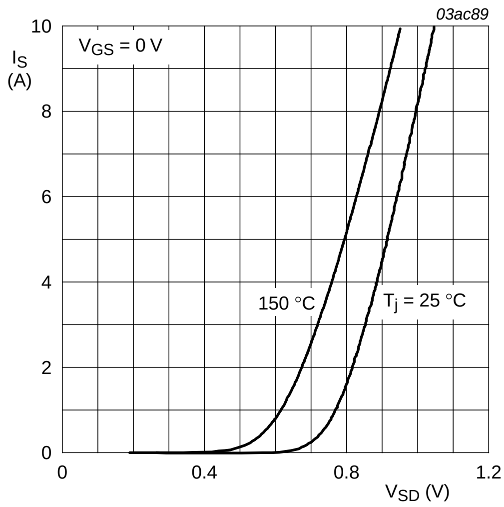
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

Fig 11. Normalized drain-source on-state resistance factor as a function of junction temperature



$I_D = 3.5A; V_{DS} = 80V$

Fig 12. Gate-source voltage as a function of gate charge; typical values

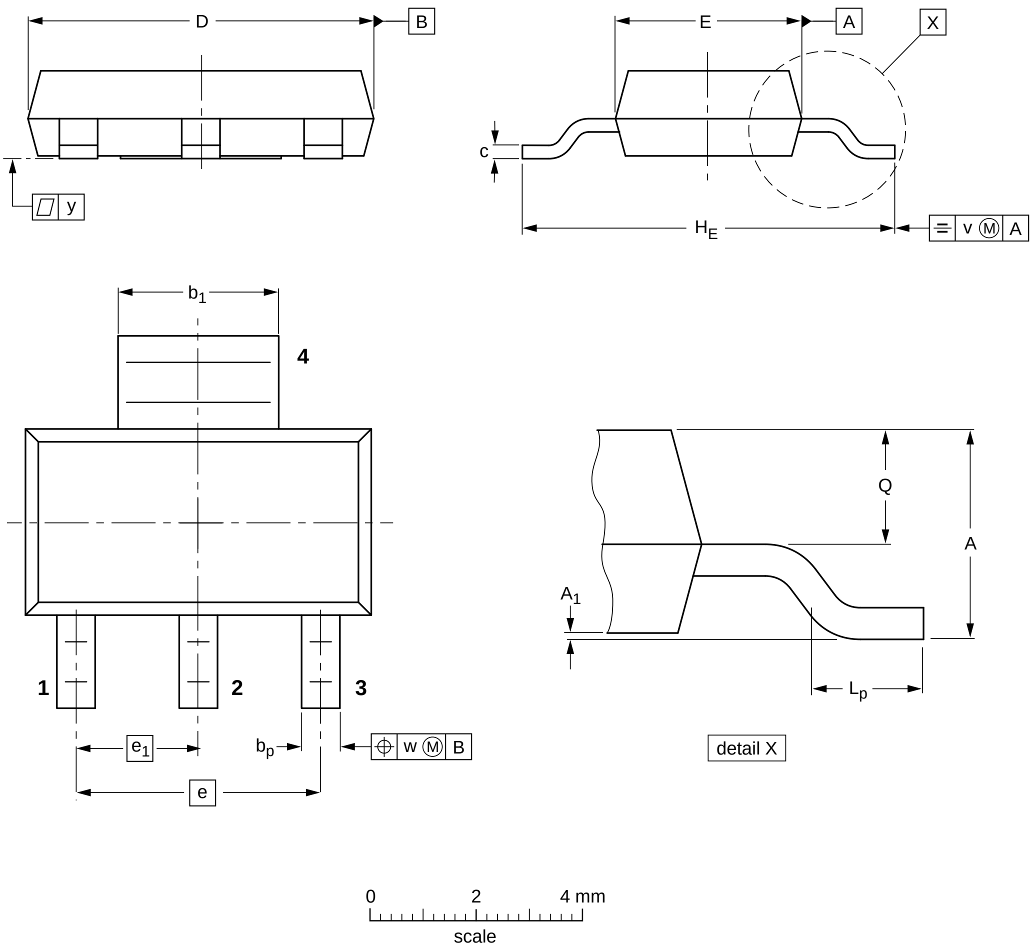


$T_j = 25°C$ and $150°C; V_{GS} = 0V$

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

8. Package outline

Plastic surface-mounted package with increased heatsink; 4 leads **SOT223**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	b_1	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.8 1.5	0.10 0.01	0.80 0.60	3.1 2.9	0.32 0.22	6.7 6.3	3.7 3.3	4.6	2.3	7.3 6.7	1.1 0.7	0.95 0.85	0.2	0.1	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT223			SC-73			~~04-11-10~~ 06-03-16

Fig 14. Package outline SOT223 (SC-73)

9. Soldering

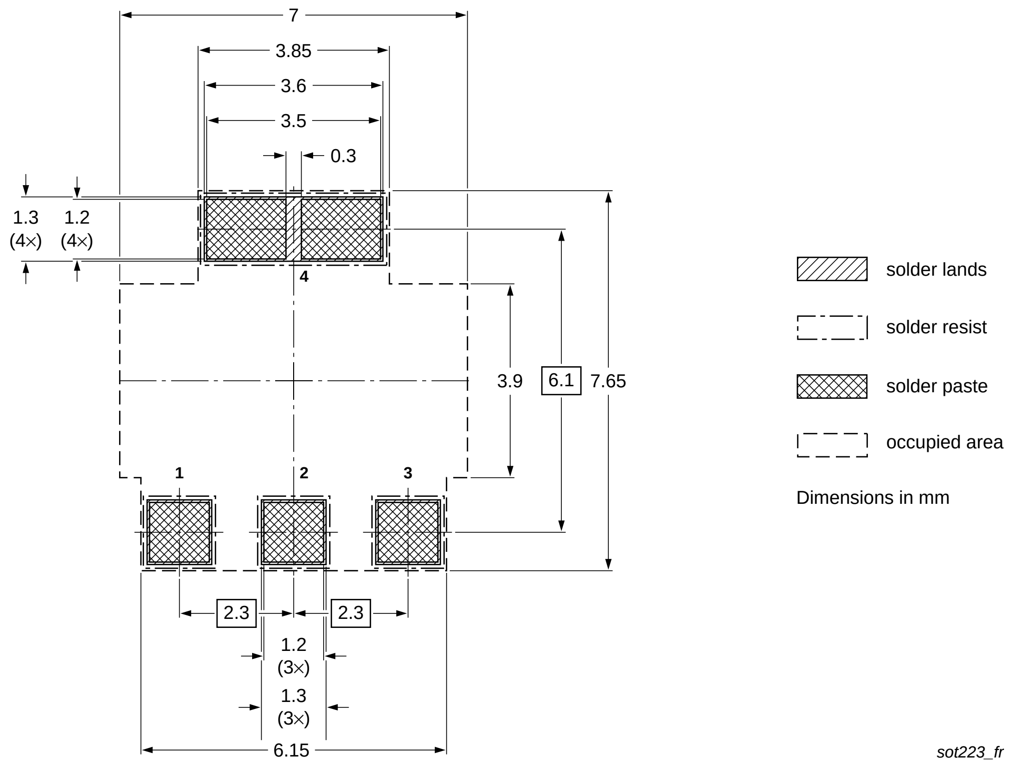


Fig 15. Reflow soldering footprint for SOT223 (SC-73)

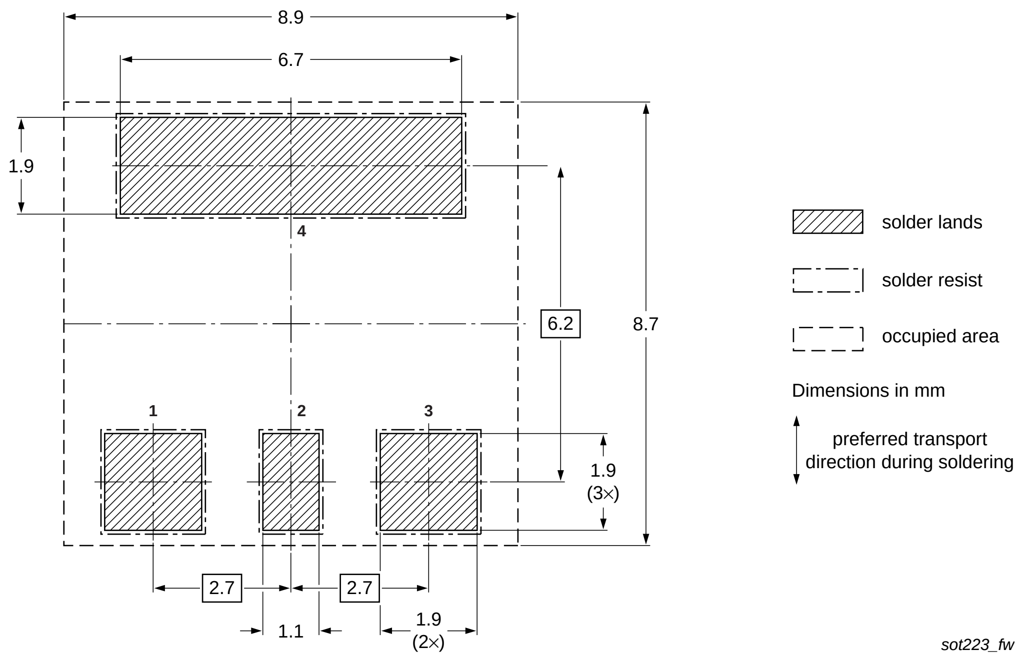


Fig 16. Wave soldering footprint for SOT223 (SC-73)

10. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHT4NQ10LT v.2	20111028	Product data sheet	-	PHT4NQ10LT v.1
Modifications:	• The format of this document has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • 1 "Product profile": updated • 7 "Characteristics": $Q_{G(tot)}$ value corrected • 11 "Legal information": updated			
PHT4NQ10LT v.1	20000911	Product specification	-	-

11. Legal information

11.1 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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13. Contents

1 Product profile 1
1.1 General description 1
1.2 Features and benefits 1
1.3 Applications 1
1.4 Quick reference data 1
2 Pinning information 1
3 Ordering information 2
4 Marking 2
5 Limiting values 2
6 Thermal characteristics 4
7 Characteristics 4
8 Package outline 8
9 Soldering 9
10 Revision history 10
11 Legal information 11
11.1 Data sheet status 11
11.2 Definitions 11
11.3 Disclaimers 11
11.4 Trademarks 12
12 Contact information 12

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