PHB23NQ10LT

N-channel TrenchMOS logic level FET

Rev. 01 — 11 July 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
- Fast switching
- TrenchMOS technology

1.3 Applications

- DC-to-DC converters
- Switched-mode power supplies
- General purpose switching

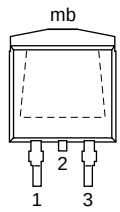
1.4 Quick reference data

- $V_{DS} \leq 100$ V
- $R_{DSon} \leq 72$ mΩ
- $I_D \leq 23$ A
- $Q_{GD} = 9.3$ nC (typ)

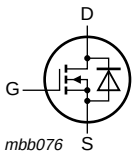
2. Pinning information

Table 1. Pinning

Pin	Description	Simplified outline	Symbol
1	gate (G)		
2	drain (D) [1]		
3	source (S)		
mb	mounting base; connected to drain		



SOT404 (D2PAK)



[1] It is not possible to make a connection to pin 2.

PHILIPS

3. Ordering information

Table 2. Ordering information

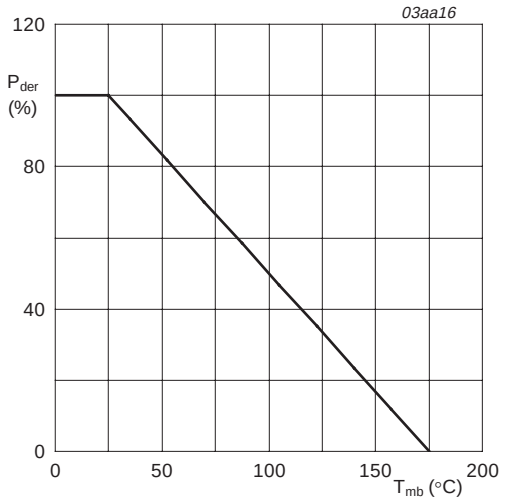
Type number	Package		
	Name	Description	Version
PHB23NQ10LT	D2PAK	plastic single-ended surface-mounted package; 3 leads (one lead cropped)	SOT404

4. Limiting values

Table 3. Limiting values

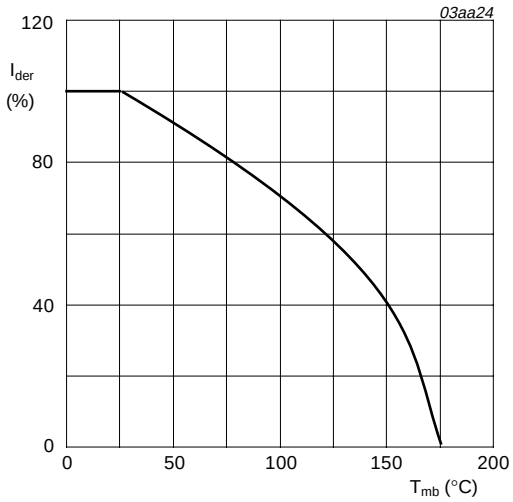
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	25 °C ≤ T_j ≤ 175 °C	-	100	V
V_{DGR}	drain-gate voltage (DC)	25 °C ≤ T_j ≤ 175 °C; R_{GS} = 20 kΩ	-	100	V
V_{GS}	gate-source voltage		-	±15	V
I_D	drain current	T_{mb} = 25 °C; V_{GS} = 10 V; see Figure 2 and 3	-	23	A
		T_{mb} = 100 °C; V_{GS} = 10 V; see Figure 2	-	16	A
I_{DM}	peak drain current	T_{mb} = 25 °C; pulsed; t_p ≤ 10 µs; see Figure 3	-	91	A
P_{tot}	total power dissipation	T_{mb} = 25 °C; see Figure 1	-	98	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 °C	-	23	A
I_{SM}	peak source current	T_{mb} = 25 °C; pulsed; t_p ≤ 10 µs	-	92	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	unclamped inductive load; I_D = 14.2 A; V_{DS} ≤ 25 V; R_{GS} = 50 Ω; V_{GS} = 5 V; starting at T_j = 25 °C	-	100	mJ



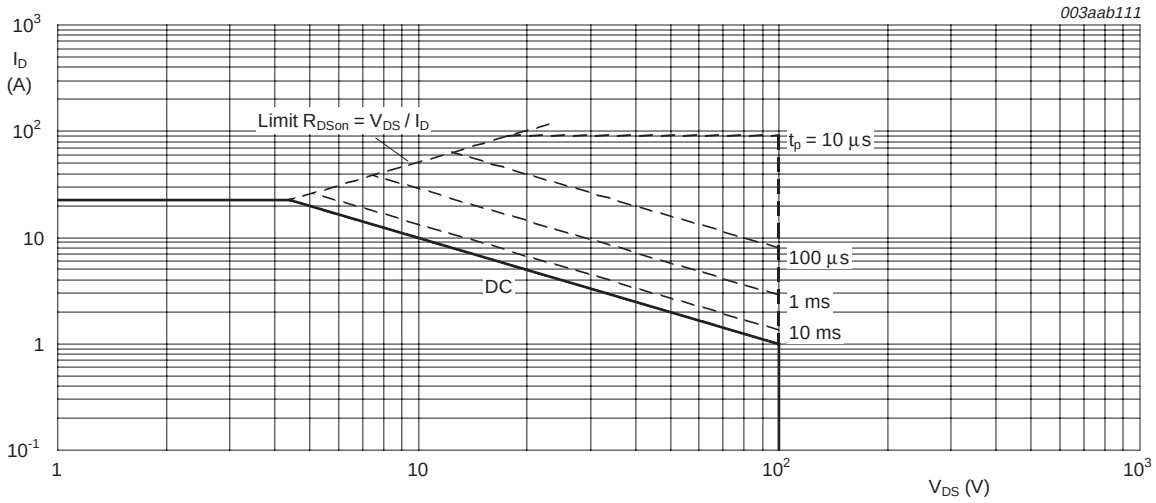
$$P_{der} = \frac{P_{tot}}{P_{tot(25°C)}} \times 100\ \%$$

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



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

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



T_{mb} = 25 °C; I_{DM} is single pulse; V_{GS} = 10 V

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
$R_{th(j\text{-}mb)}$	thermal resistance from junction to mounting base	see Figure 4	-	-	1.5	K/W
$R_{th(j\text{-}a)}$	thermal resistance from junction to ambient	minimum footprint, FR4 board	-	50	-	K/W

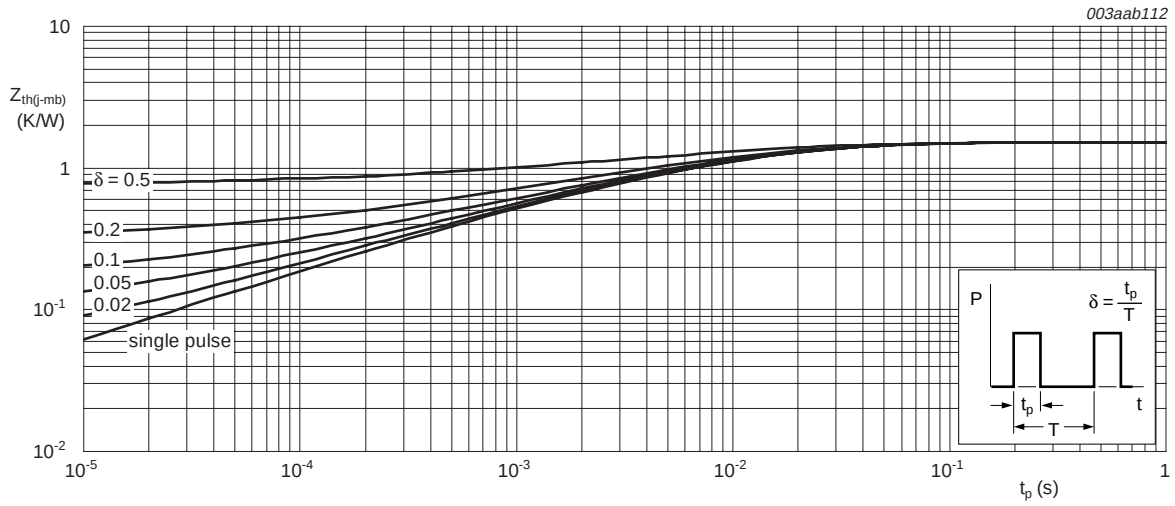


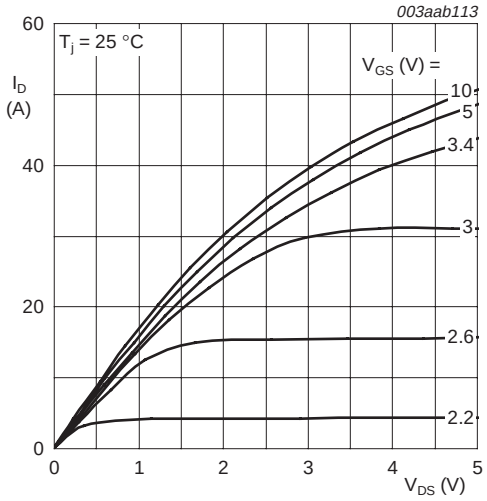
Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

Table 5. Characteristics

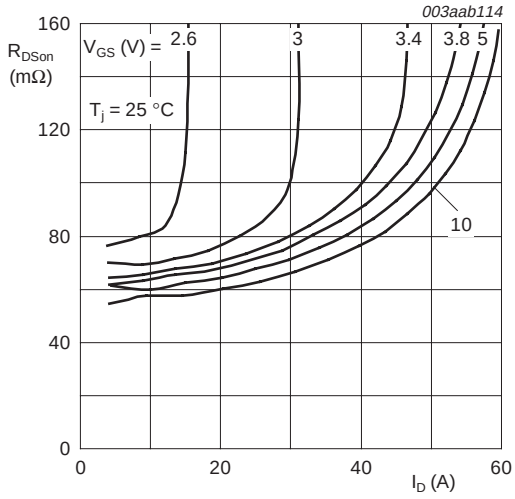
T_j = 25 °C unless otherwise specified.

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	100	-	-	V
		T_j = –55 °C	89	-	-	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} = 100 V; V_{GS} = 0 V				
		T_j = 25 °C	-	0.05	10	µA
		T_j = 175 °C	-	-	500	µA
I_{GSS}	gate leakage current	V_{GS} = ±10 V; V_{DS} = 0 V	-	2	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 5 V; I_D = 10 A; see Figure 6 and 8				
		T_j = 25 °C	-	60	75	mΩ
		T_j = 175 °C	-	-	203	mΩ
		V_{GS} = 10 V; I_D = 10 A; see Figure 6 and 8	-	55	72	mΩ
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = 25 A; V_{DS} = 44 V; V_{GS} = 10 V; see Figure 11 and 12	-	49	-	nC
Q_{GS}	gate-source charge		-	3.7	-	nC
Q_{GD}	gate-drain charge		-	9.3	-	nC
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 25 V; f = 1 MHz	-	1278	1704	pF
C_{oss}	output capacitance		-	129	155	pF
C_{rss}	reverse transfer capacitance		-	88	120	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	-	13	20	ns
t_r	rise time		-	120	168	ns
$t_{d(off)}$	turn-off delay time		-	58	87	ns
t_f	fall time		-	57	86	ns
Source-drain diode						
V_{SD}	source-drain voltage	I_S = 10 A; V_{GS} = 0 V; see Figure 13	-	0.85	1.2	V
		I_S = 23 A; V_{GS} = 0 V	-	1.1	-	V
t_{rr}	reverse recovery time	I_S = 20 A; dI_S/dt = –100 A/µs; V_{GS} = 0 V; V_R = 30 V	-	6.3	-	ns
Q_r	recovered charge		-	0.22	-	µC



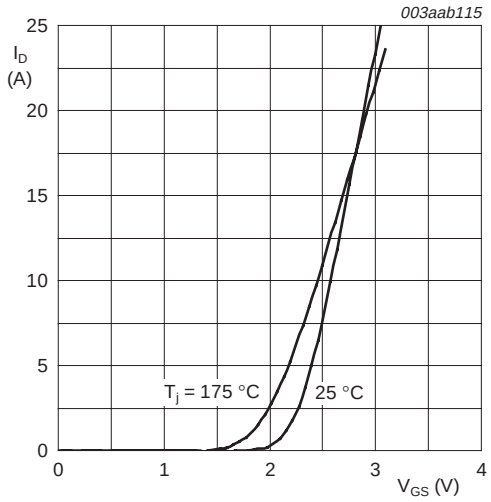
T_j = 25 °C

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



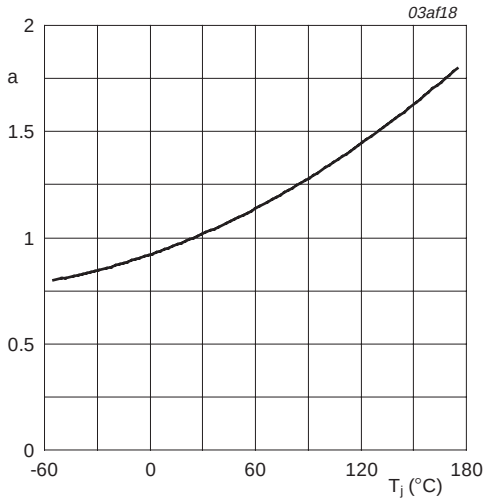
T_j = 25 °C

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



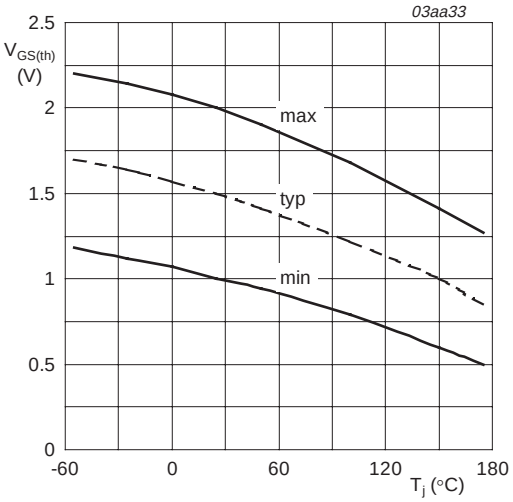
T_j = 25 °C and 175 °C; $V_{DS} > I_D \times R_{DSon}$

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



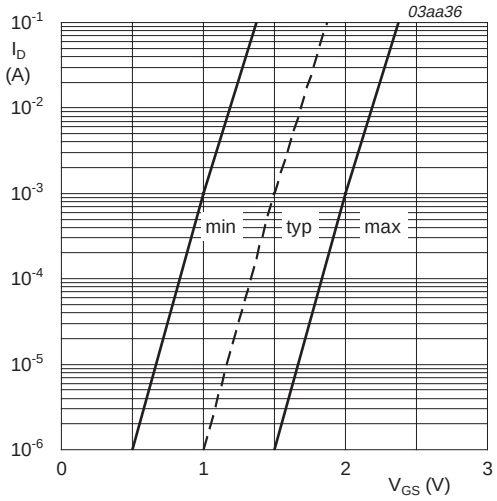
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



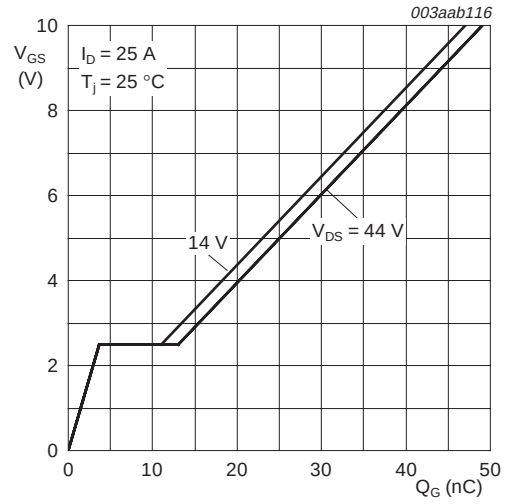
I_D = 1 mA; V_{DS} = V_{GS}

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



T_j = 25 °C; V_{DS} = 5 V

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



I_D = 25 A; V_{DS} = 14 V and 44 V

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

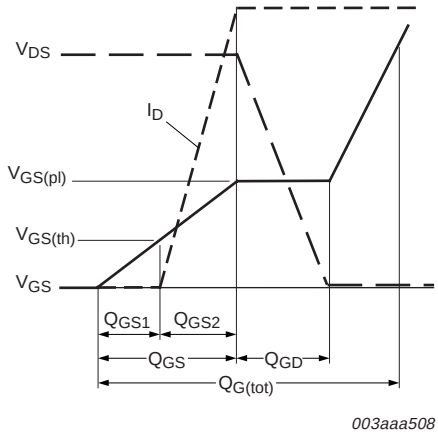
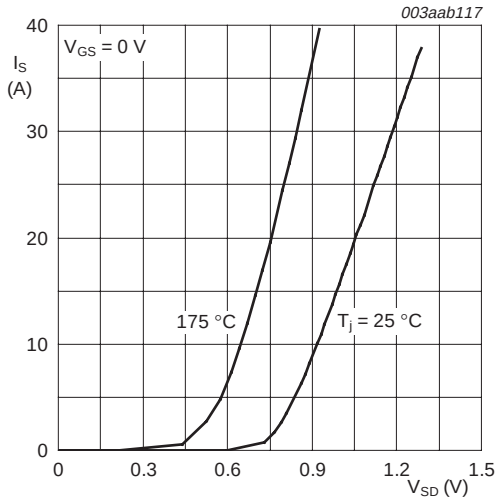


Fig 12. Gate charge waveform definitions

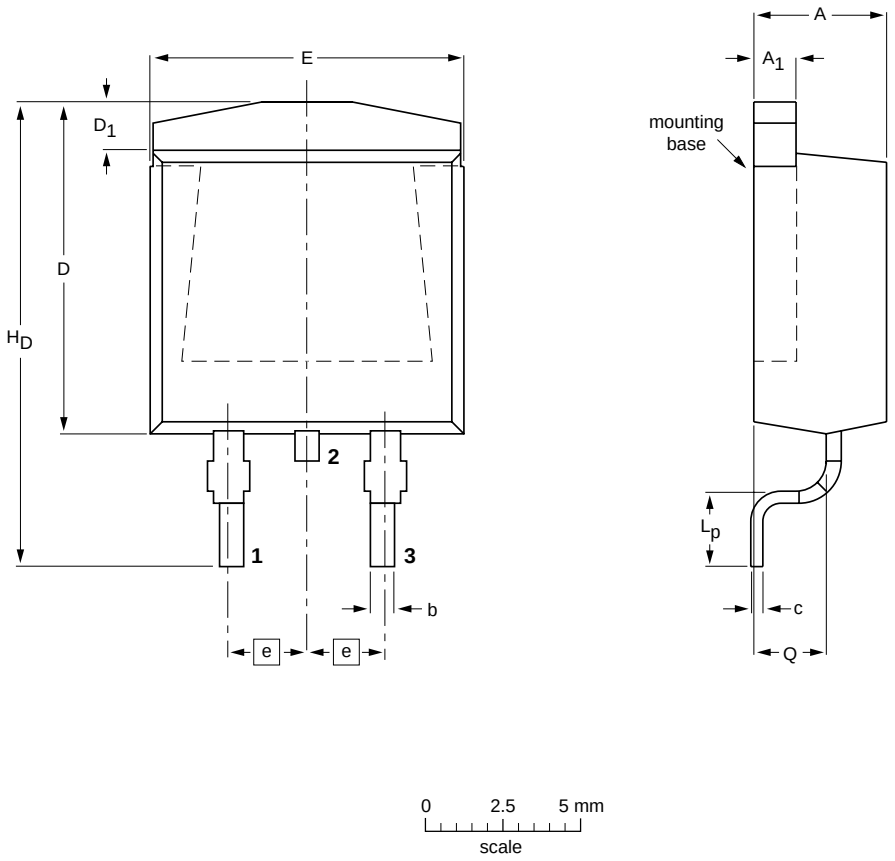


T_j = 25 °C and 175 °C; V_{GS} = 0 V

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

7. Package outline

Plastic single-ended surface-mounted package (D2PAK); 3 leads (one lead cropped) **SOT404**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b	c	D max.	D_1	E	e	L_p	H_D	Q
mm	4.50 4.10	1.40 1.27	0.85 0.60	0.64 0.46	11	1.60 1.20	10.30 9.70	2.54	2.90 2.10	15.80 14.80	2.60 2.20

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT404						~~05-02-11~~ 06-03-16

Fig 14. Package outline SOT404 (D2PAK)

8. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHB23NQ10LT_1	20060711	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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.semiconductors.philips.com.

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