

PHP/PHU66NQ03LT

N-channel TrenchMOS™ logic level FET

Rev. 06 — 12 August 2004

Product data sheet

1. Product profile

1.1 General description

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

1.2 Features

- Logic level threshold
- Low on-state resistance.

1.3 Applications

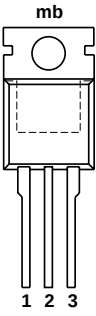
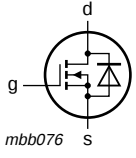
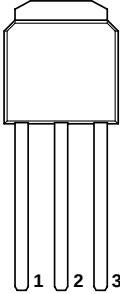
- DC-to-DC converters
- General purpose switching.

1.4 Quick reference data

- $V_{DS} \leq 25 \text{ V}$
- $I_D \leq 66 \text{ A}$
- $R_{DS(on)} \leq 10.5 \text{ m}\Omega$
- $Q_{gd} = 3.6 \text{ nC (typ.)}$

2. Pinning information

Table 1: Discrete pinning

Pin	Description	Simplified outline	Symbol
1	gate (g)		
2	drain (d)		
3	source (s)		
mb	mounting base; connected to drain (d)		
			
		Top view	
		SOT78 (TO-220AB)	SOT533 (I-PAK)

PHILIPS

3. Ordering information

Table 2: Ordering information

Type number	Package		
	Name	Description	Version
PHP66NQ03LT	TO-220AB	Plastic single-ended package; heatsink mounted; 1 mounting hole; 3 lead TO-220AB	SOT78
PHU66NQ03LT	I-PAK	Plastic single-ended package (Philips version of I-PAK); 3 leads (in-line)	SOT533

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 (DC)	$25\text{ °C} \leq T_j \leq 175\text{ °C}$	-	25	V
V_{DGR}	drain-gate voltage (DC)	$25\text{ °C} \leq T_j \leq 175\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	25	V
V_{GS}	gate-source voltage (DC)		-	± 20	V
I_D	drain current (DC)	$T_{mb} = 25\text{ °C}$; $V_{GS} = 5\text{ V}$; Figure 2 and 3	-	57	A
		$T_{mb} = 100\text{ °C}$; $V_{GS} = 5\text{ V}$; Figure 2	-	40	A
		$T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$	-	66	A
		$T_{mb} = 100\text{ °C}$; $V_{GS} = 10\text{ V}$	-	45	A
I_{DM}	peak drain current	$T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$; Figure 3	-	228	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Figure 1	-	93	W
T_{stg}	storage temperature		-55	+175	°C
T_j	junction temperature		-55	+175	°C

Source-drain diode

I_S	source (diode forward) current (DC)	$T_{mb} = 25\text{ °C}$	-	57	A
I_{SM}	peak source (diode forward) current	$T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$	-	228	A

Avalanche ruggedness

$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	unclamped inductive load; $I_D = 43\text{ A}$; $t_p = 0.15\text{ ms}$; $V_{DD} \leq 25\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 10\text{ V}$; starting at $T_j = 25\text{ °C}$	-	90	mJ
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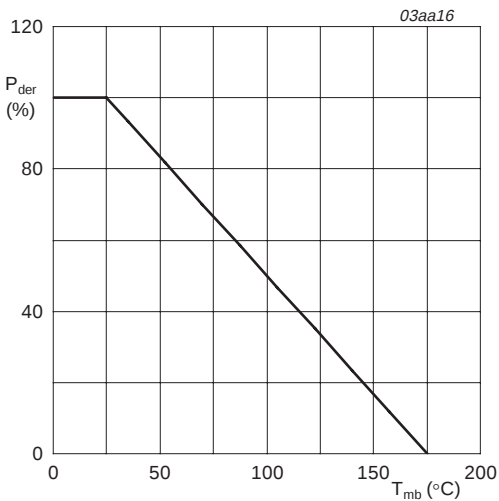


Fig 1. Normalized total power dissipation as a function of mounting base temperature.

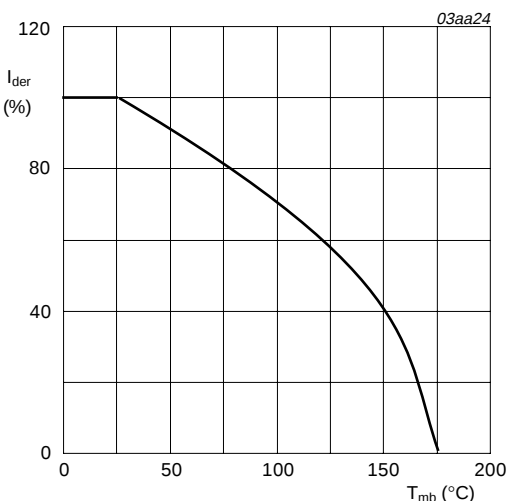
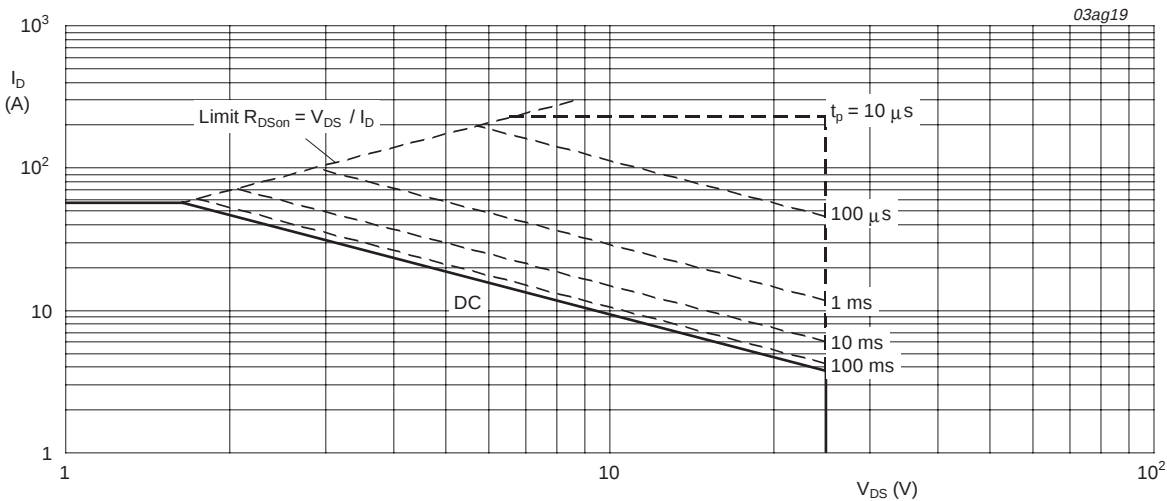


Fig 2. Normalized continuous drain current as a function of mounting base temperature.



$T_{mb} = 25^{\circ}C$; I_{DM} is single pulse; $V_{GS} = 5 V$

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
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Figure 4	-	-	1.6	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient					
	SOT78	vertical in free air	-	60	-	K/W
	SOT533		-	70	-	K/W

5.1 Transient thermal impedance

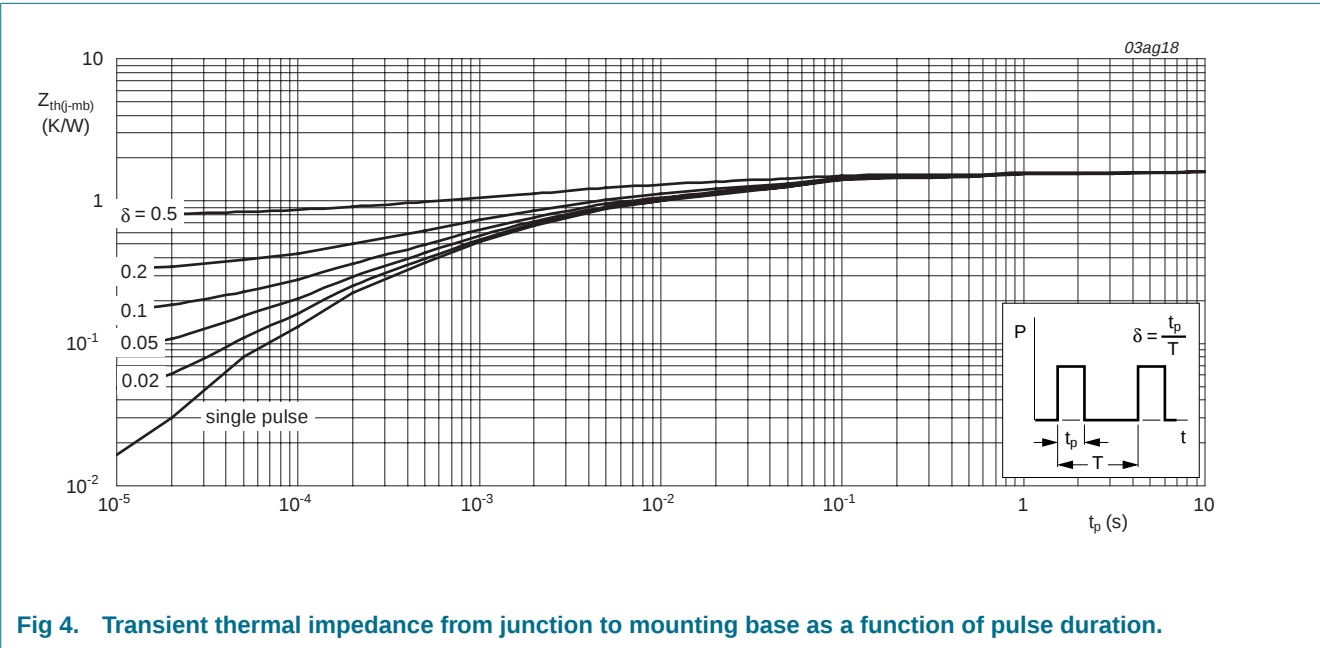


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration.

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	$I_D = 250\text{ }\mu\text{A}$; $V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ °C}$	25	-	-	V
		$T_j = -55\text{ °C}$	22	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$; Figure 9 and 10				
		$T_j = 25\text{ °C}$	1	1.5	2	V
		$T_j = 175\text{ °C}$	0.5	-	-	V
		$T_j = -55\text{ °C}$	-	-	2.2	V
I_{DSS}	drain-source leakage current	$V_{DS} = 25\text{ V}$; $V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ °C}$	-	-	10	μA
		$T_j = 175\text{ °C}$	-	-	500	μA
I_{GSS}	gate-source leakage current	$V_{GS} = \pm 15\text{ V}$; $V_{DS} = 0\text{ V}$	-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; Figure 6 and 8				
		$T_j = 25\text{ °C}$	-	9.1	10.5	m Ω
		$T_j = 175\text{ °C}$	-	16.4	18.9	m Ω
		$V_{GS} = 5\text{ V}$; $I_D = 25\text{ A}$; Figure 6 and 8	-	11.2	13.6	m Ω
Dynamic characteristics						
$Q_{g(tot)}$	total gate charge	$I_D = 50\text{ A}$; $V_{DS} = 15\text{ V}$; $V_{GS} = 5\text{ V}$; Figure 11	-	12	-	nC
Q_{gs}	gate-source charge		-	4.5	-	nC
Q_{gd}	gate-drain (Miller) charge		-	3.6	-	nC
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 25\text{ V}$; $f = 1\text{ MHz}$; Figure 13	-	860	-	pF
C_{oss}	output capacitance		-	330	-	pF
C_{rss}	reverse transfer capacitance		-	145	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 15\text{ V}$; $R_L = 0.6\text{ }\Omega$; $V_{GS} = 5\text{ V}$; $R_G = 5.6\text{ }\Omega$	-	15	25	ns
t_r	rise time		-	90	135	ns
$t_{d(off)}$	turn-off delay time		-	25	40	ns
t_f	fall time		-	25	40	ns
Source-drain diode						
V_{SD}	source-drain (diode forward) voltage	$I_S = 25\text{ A}$; $V_{GS} = 0\text{ V}$; Figure 12	-	0.95	1.2	V
t_{rr}	reverse recovery time	$I_S = 10\text{ A}$; $dI_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$; $V_R = 25\text{ V}$	-	32	-	ns
Q_r	recovered charge		-	20	-	nC

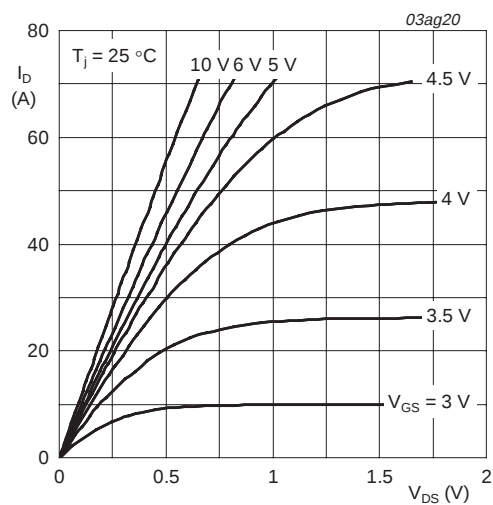


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values.

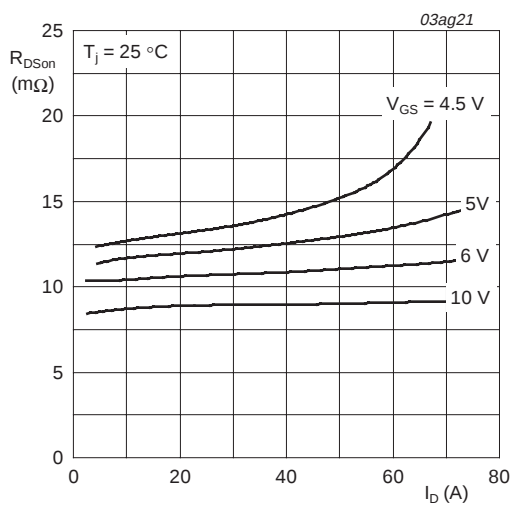


Fig 6. Drain-source on-state resistance as a function of drain current; typical values.

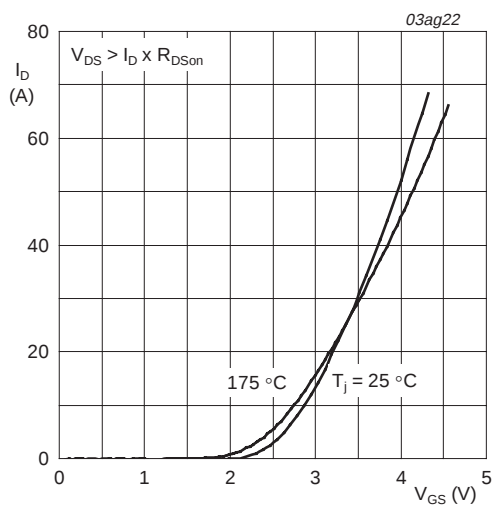


Fig 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values.

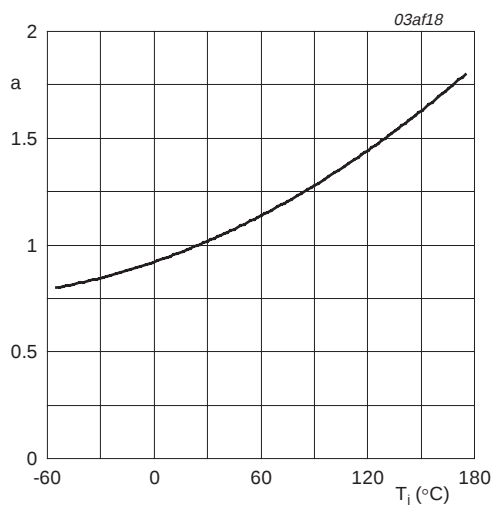
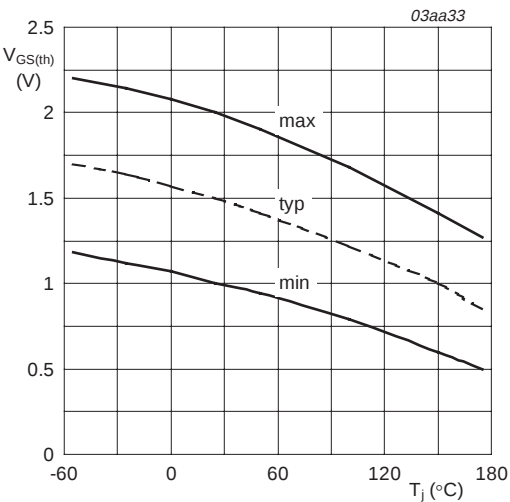
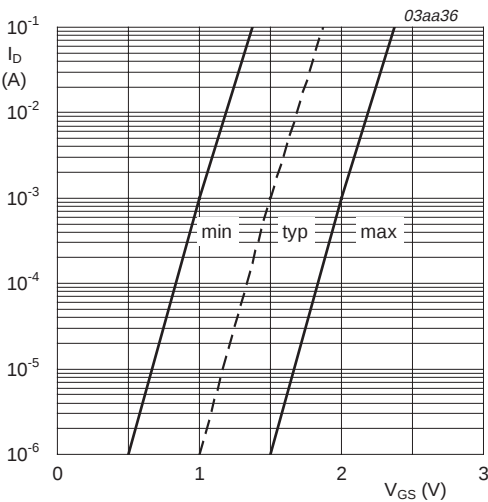


Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature.



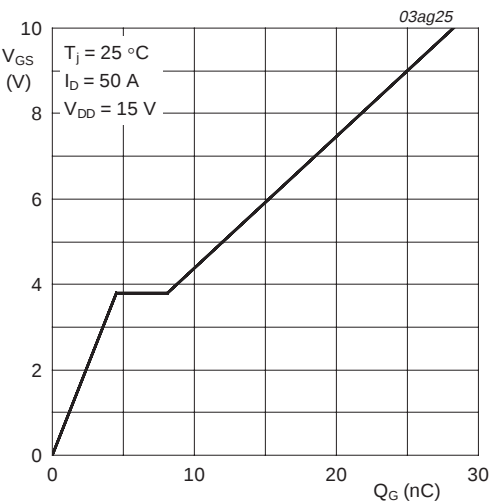
$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$

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



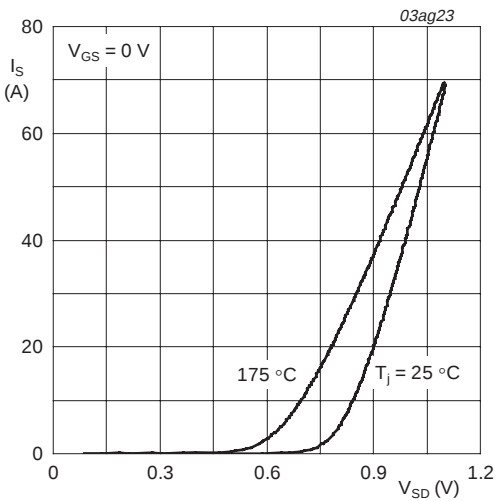
$T_j = 25\text{ }^{\circ}C$; $V_{DS} = 5\text{ V}$

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



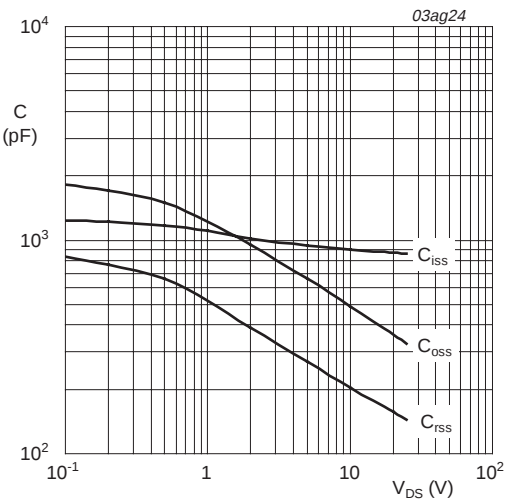
$I_D = 50\text{ A}$; $V_{DS} = 15\text{ V}$

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



$T_J = 25^\circ\text{C}$ and 175°C ; $V_{GS} = 0$ V

Fig 12. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values.



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

Fig 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values.

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB SOT78

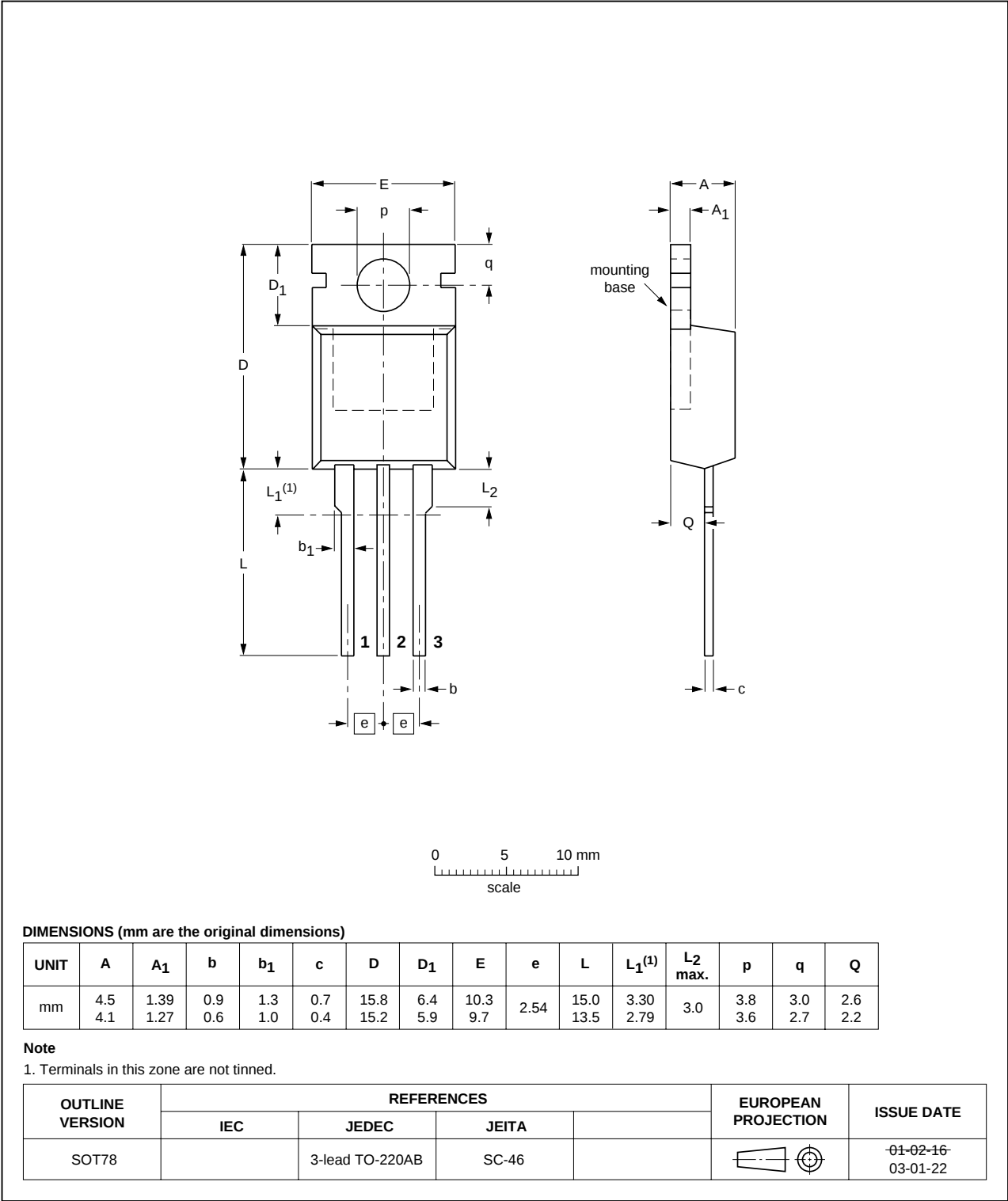
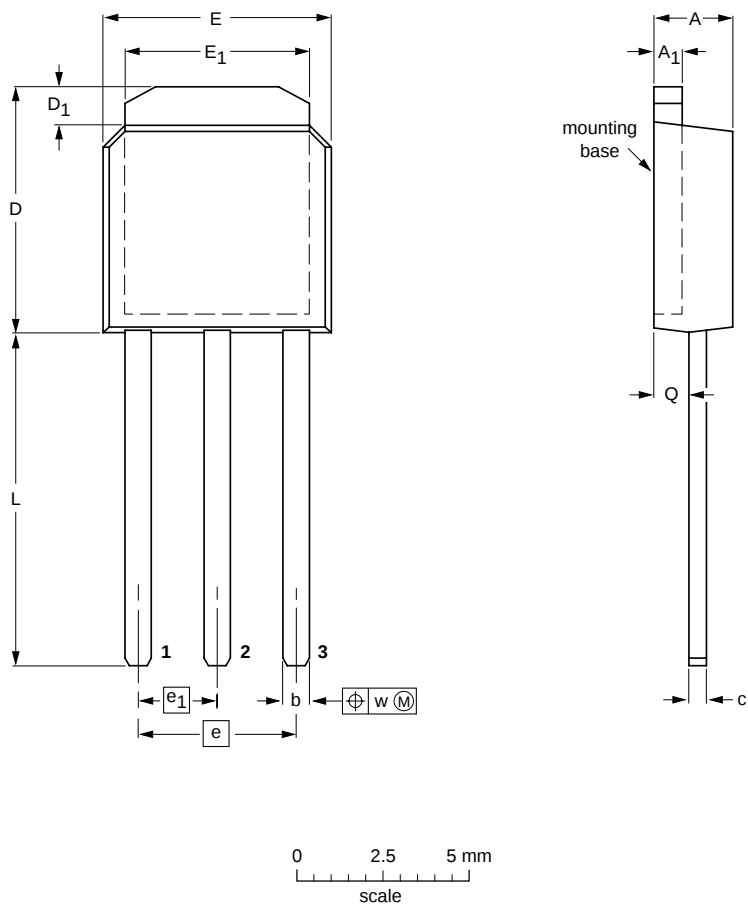


Fig 14. SOT78 (TO-220AB) package outline.

Plastic single-ended package (Philips version of I-PAK); 3 leads (in-line)

SOT533



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁	b	c	D	D ₁	E	E ₁	e	e ₁	L	Q
mm	2.38 2.22	0.89 0.71	0.89 0.71	0.56 0.46	7.28 6.94	1.06 0.96	6.73 6.47	5.36 5.26	4.57	2.285	9.8 9.4	1.00 1.10

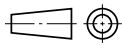
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT533		TO-251				99-02-18

Fig 15. SOT533 (I-PAK) package outline.

8. Revision history

Table 6: Revision history

Document ID	Release date	Data sheet status	Change notice	Document number	Supersedes
PHP_PHU66NQ03LT_6	20040812	Product data sheet	-	9397 750 13428	PHP_PHB_PHD66NQ03LT_5
Modifications:		• Removal of PHB66NQ03LT (now in separate data sheet) • Removal of PHD66NQ03LT (now in separate data sheet) • Addition of PHU66NQ03LT. • Data sheet updated to latest standard.			
PHP_PHB_PHD66NQ03LT_5	20040415	Product data sheet	-	9397 750 13107	PHP_PHB_PHD66NQ03LT_4
PHP_PHB_PHD66NQ03LT_4	20020909	Product data sheet	-	9397 750 10158	PHP_PHB_PHD66NQ03LT_3
PHP_PHB_PHD66NQ03LT_3	20020312	Product data sheet	-	9397 750 09284	PHP_PHB_PHD66NQ03LT_2
PHP_PHB_PHD66NQ03LT_2	20011210	Product data sheet	-	9397 750 09119	PHP_PHB_PHD66NQ03LT_1
PHP_PHB_PHD66NQ03LT_1	20011012	Product data sheet	-	9397 750 08725	-

9. 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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