

Rev. 01 — 06 May 2004

3. Ordering information

Table 2: Ordering information

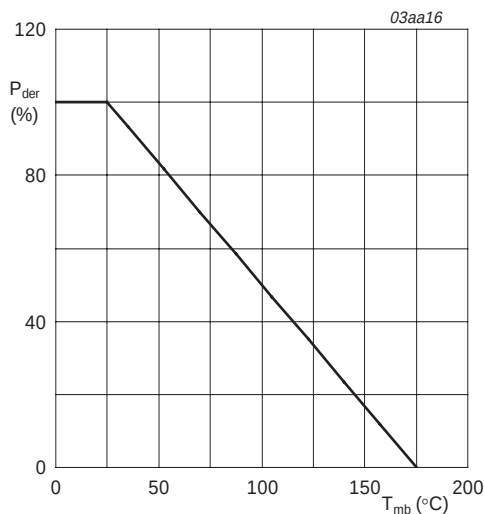
Type number	Package		Version
	Name	Description	
PHP193NQ06T	TO-220AB	Plastic single-ended package; heatsink mounted; 1 mounting hole; 3 leads	SOT78
PHB193NQ06T	D ² -PAK	Plastic single-ended surface mounted package; 3 leads (one lead cropped)	SOT404

4. Limiting values

Table 3: Limiting values

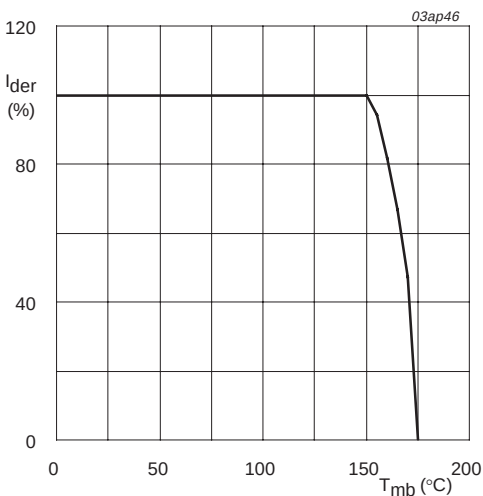
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V _{DS}	drain-source voltage (DC)	25 °C ≤ T _j ≤ 175 °C	-	55	V
V _{DGR}	drain-gate voltage (DC)	25 °C ≤ T _j ≤ 175 °C; R _{GS} = 20 kΩ	-	55	V
V _{GS}	gate-source voltage (DC)		-	±20	V
I _D	drain current (DC)	T _{mb} = 25 °C; V _{GS} = 10 V; Figure 2 and 3	-	75	A
		T _{mb} = 100 °C; V _{GS} = 10 V; Figure 2	-	75	A
I _{DM}	peak drain current	T _{mb} = 25 °C; pulsed; t _p ≤ 10 μs; Figure 3	-	240	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; Figure 1	-	300	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 °C	-	75	A
I _{SM}	peak source (diode forward) current	T _{mb} = 25 °C; pulsed; t _p ≤ 10 μs	-	240	A
Avalanche ruggedness					
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	unclamped inductive load; I _D = 75 A; t _p = 0.21 ms; V _{DD} ≤ 55 V; R _{GS} = 50 Ω; V _{GS} = 10 V; starting at T _j = 25 °C	-	560	mJ



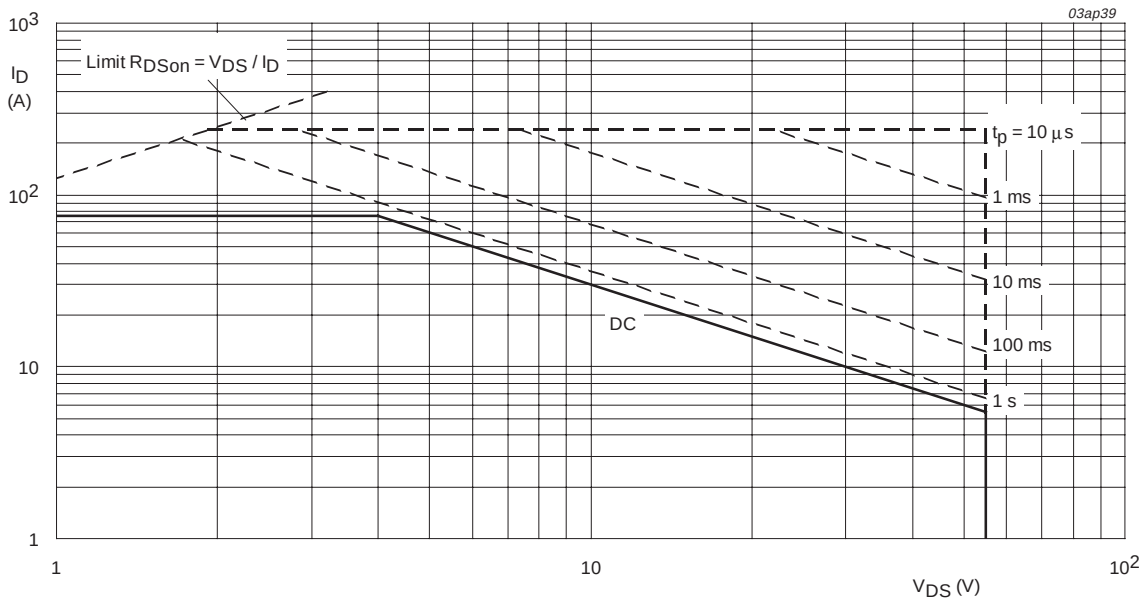
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

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; $V_{GS} = 10$ V.

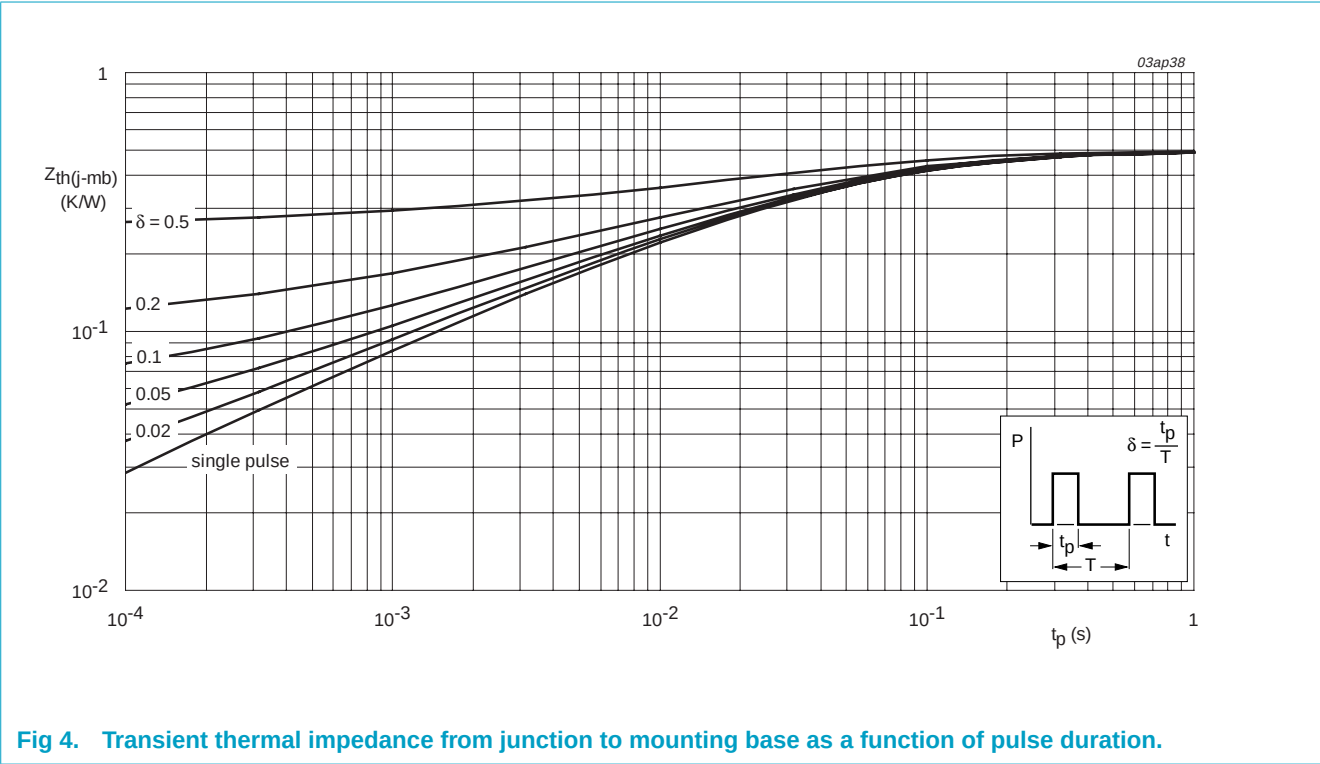
Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage.

5. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Figure 4	-	-	0.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient					
	SOT78	vertical in still air	-	60	-	K/W
	SOT404	mounted on a printed-circuit board; minimum footprint.	-	50	-	K/W

5.1 Transient thermal impedance



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	$I_D = 250\text{ }\mu\text{A}$; $V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ °C}$	55	-	-	V
		$T_j = -55\text{ °C}$	50	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$; Figure 9 and 10				
		$T_j = 25\text{ °C}$	2	3	4	V
		$T_j = 175\text{ °C}$	1	-	-	V
		$T_j = -55\text{ °C}$	-	-	4.4	V
I_{DSS}	drain-source leakage current	$V_{DS} = 55\text{ V}$; $V_{GS} = 0\text{ V}$				
		$T_j = 25\text{ °C}$	-	-	1	μA
		$T_j = 175\text{ °C}$	-	-	500	μA
I_{GSS}	gate-source leakage current	$V_{GS} = \pm 20\text{ V}$; $V_{DS} = 0\text{ V}$	-	2	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; Figure 7 and 8				
		$T_j = 25\text{ °C}$	-	3.4	4	m Ω
		$T_j = 175\text{ °C}$	-	6.8	8	m Ω
Dynamic characteristics						
$Q_{g(tot)}$	total gate charge	$I_D = 25\text{ A}$; $V_{DD} = 44\text{ V}$; $V_{GS} = 10\text{ V}$; Figure 13	-	85.6	-	nC
Q_{gs}	gate-source charge		-	18.4	-	nC
Q_{gd}	gate-drain (Miller) charge		-	24.6	-	nC
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 25\text{ V}$; $f = 1\text{ MHz}$; Figure 11	-	5082	-	pF
C_{oss}	output capacitance		-	1054	-	pF
C_{rss}	reverse transfer capacitance		-	289	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DD} = 30\text{ V}$; $R_L = 1.2\text{ }\Omega$;	-	23	-	ns
t_r	rise time	$V_{GS} = 10\text{ V}$; $R_G = 10\text{ }\Omega$	-	51	-	ns
$t_{d(off)}$	turn-off delay time		-	71	-	ns
t_f	fall time		-	41	-	ns
Source-drain diode						
V_{SD}	source-drain (diode forward) voltage	$I_S = 25\text{ A}$; $V_{GS} = 0\text{ V}$; Figure 12	-	0.8	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}$; $dI_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$	-	95	-	ns
Q_r	recovered charge		-	251	-	nC

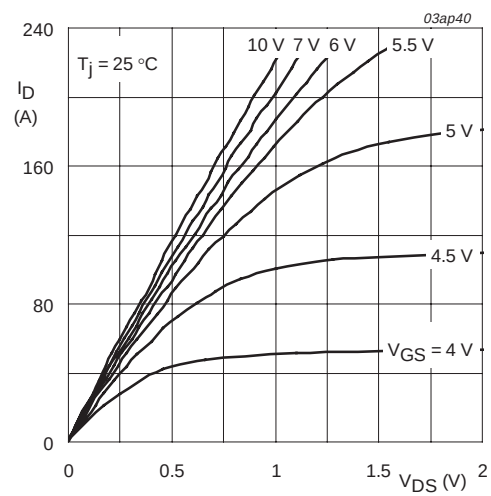


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values.

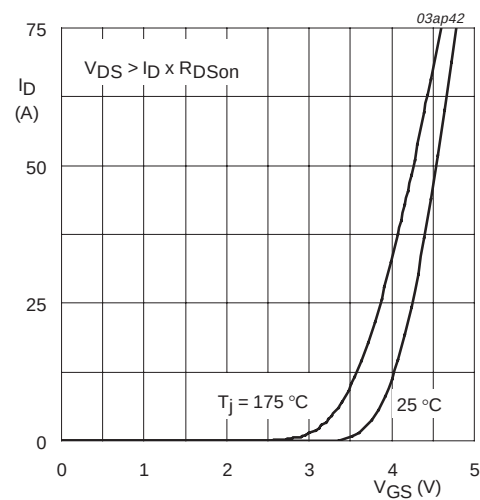


Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values.

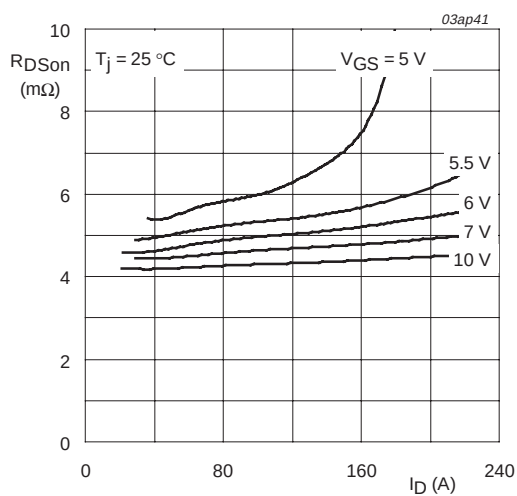


Fig 7. Drain-source on-state resistance as a function of drain current; typical values.

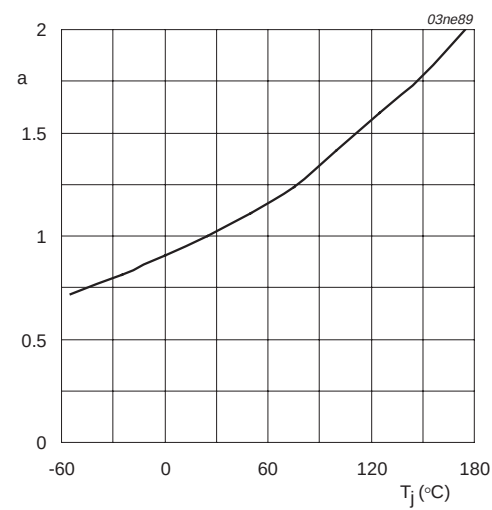
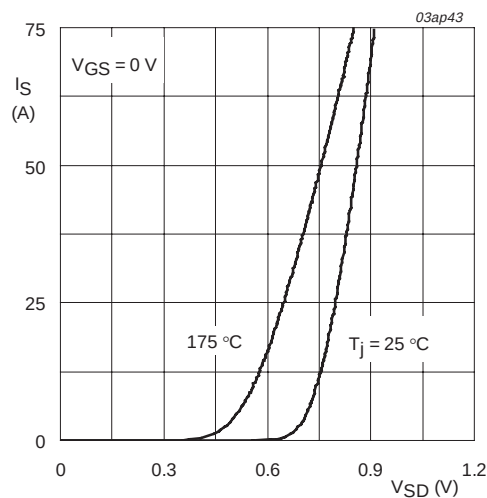


Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature.

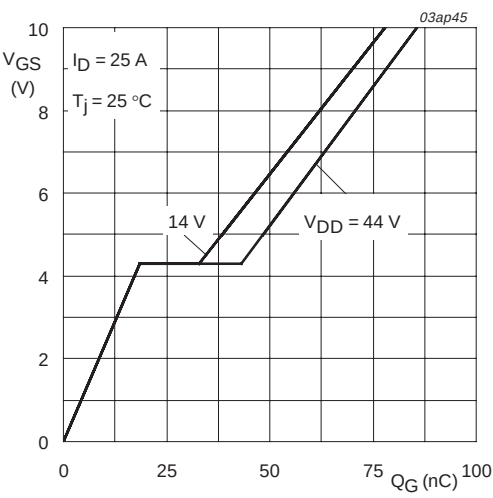
 $V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$

Fig 11. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values.



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

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



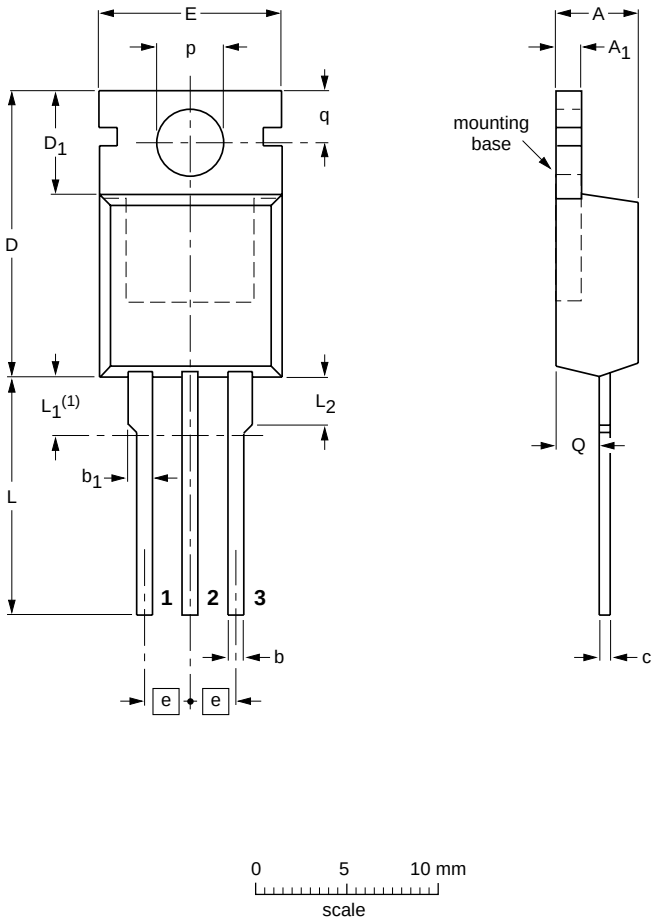
$I_D = 25\text{ A}$; $V_{DD} = 14\text{ V}$ and 44 V

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

7. Package outline

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

SOT78



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁	b	b ₁	c	D	D ₁	E	e	L	L ₁ ⁽¹⁾	L ₂ max.	p	q	Q
mm	4.5 4.1	1.39 1.27	0.9 0.7	1.3 1.0	0.7 0.4	15.8 15.2	6.4 5.9	10.3 9.7	2.54	15.0 13.5	3.30 2.79	3.0	3.8 3.6	3.0 2.7	2.6 2.2

Note

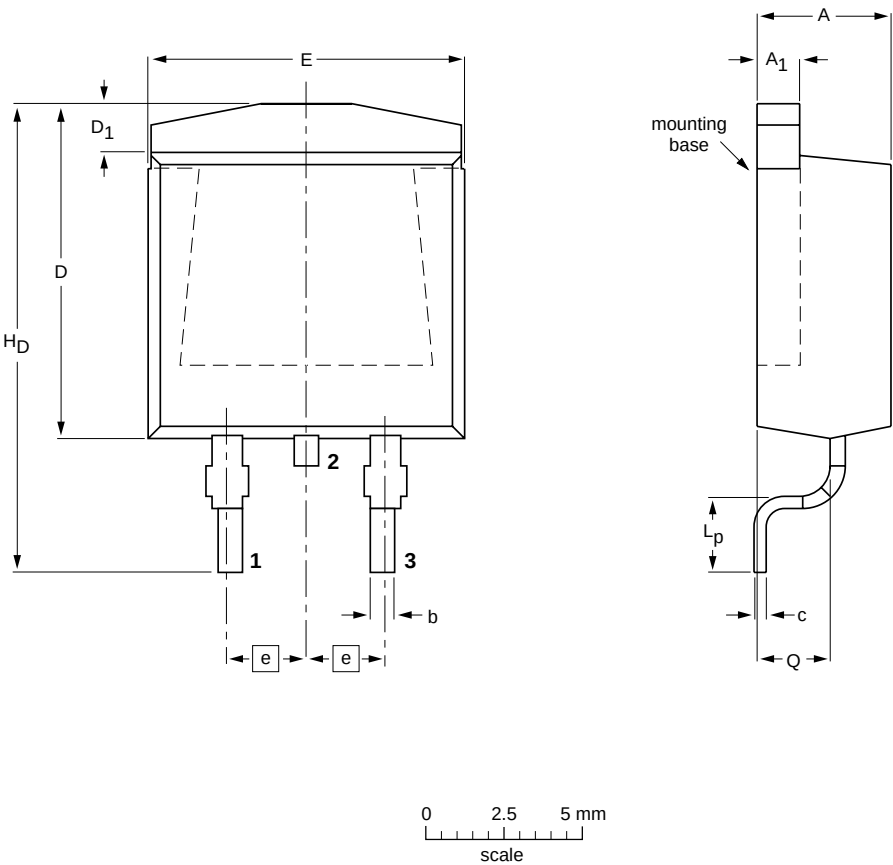
1. Terminals in this zone are not tinned.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT78		3-lead TO-220AB	SC-46			00-09-07 01-02-16

Fig 14. SOT78 (TO220-AB).

Plastic single-ended surface mounted package (Philips version of D²-PAK); 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	EIAJ			
SOT404						99-06-25 01-02-12

Fig 15. SOT404 (D²-PAK).

8. Revision history

Table 6: Revision history

Rev	Date	CPCN	Description
01	20040506	-	Product data (9397 750 13169).

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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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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Product data

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