

1. Product profile

1.1 Description

SiliconMAX™ products use the latest Philips TrenchMOS™ technology to achieve the lowest possible on-state resistance in each package.

1.2 Features

- Fast switching
- Low on-state resistance
- Avalanche ruggedness rated
- Low thermal resistance.

1.3 Applications

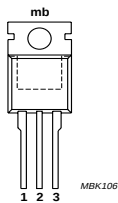
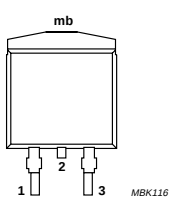
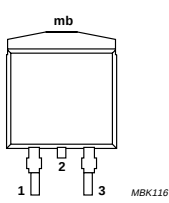
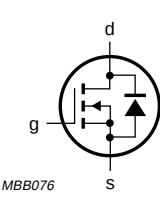
- DC-to-DC converters
- Uninterruptable power supplies

1.4 Quick reference data

- $V_{DS} \leq 75 \text{ V}$
- $I_D \leq 75 \text{ A}$
- $P_{tot} \leq 230 \text{ W}$
- $R_{DSon} \leq 8.5 \text{ m}\Omega$

2. Pinning information

Table 1: Pinning - SOT78 and SOT404, simplified outline and symbol

Pin	Description	Simplified outline	Symbol
1	gate (g)		
2	drain (d) [1]		
3	source (s)		
mb	mounting base; connected to drain (d)		
		SOT78 (TO-220AB)	SOT404 (D²-PAK)

[1] It is not possible to make connection to pin 2 of the SOT404 package.

3. Ordering information

Table 2: Ordering information

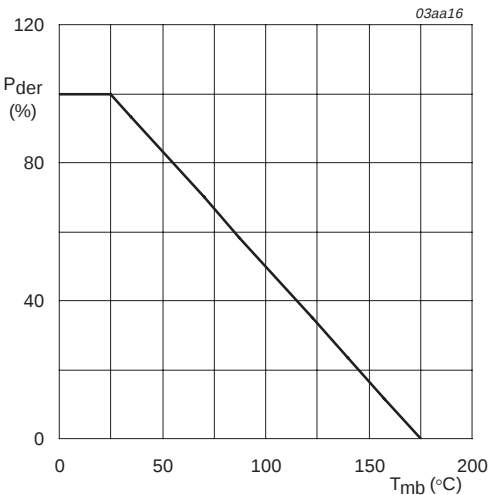
Type number	Package		
	Name	Description	Version
PSMN008-75P	TO-220AB	Plastic single-ended package; heatsink mounted; 1 mounting hole; 3 leads	SOT78
PSMN008-75B	D ² -PAK	Plastic single-ended surface mounted package; 3 leads (1 lead cropped)	SOT404

4. Limiting values

Table 3: Limiting values

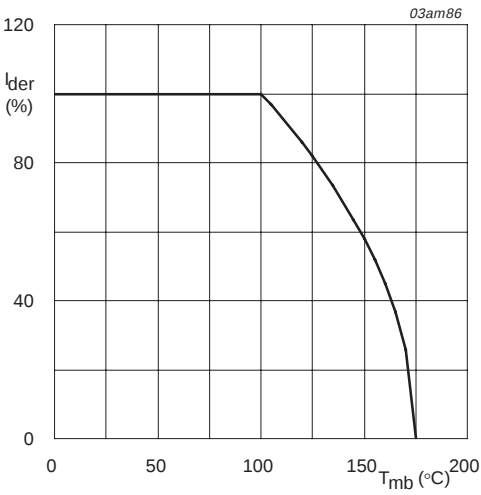
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage (DC)	$25\text{ °C} \leq T_j \leq 175\text{ °C}$	-	75	V
V_{DGR}	drain-gate voltage (DC)	$25\text{ °C} \leq T_j \leq 175\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	75	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	-	75	A
		$T_{mb} = 100\text{ °C}$; $V_{GS} = 10\text{ V}$; Figure 2	-	75	A
I_{DM}	peak drain current	$T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$; Figure 2 and 3	-	240	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; Figure 1	-	230	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)	$T_{mb} = 25\text{ °C}$	-	75	A
I_{SM}	peak source (diode forward) current	$T_{mb} = 25\text{ °C}$; pulsed; $t_p \leq 10\text{ }\mu\text{s}$	-	240	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	unclamped inductive load; $I_D = 63\text{ A}$; $t_p = 0.129\text{ ms}$; $V_{DD} \leq 15\text{ V}$; $R_{GS} = 50\text{ }\Omega$; $V_{GS} = 10\text{ V}$; starting $T_j = 25\text{ °C}$;	-	395	mJ



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

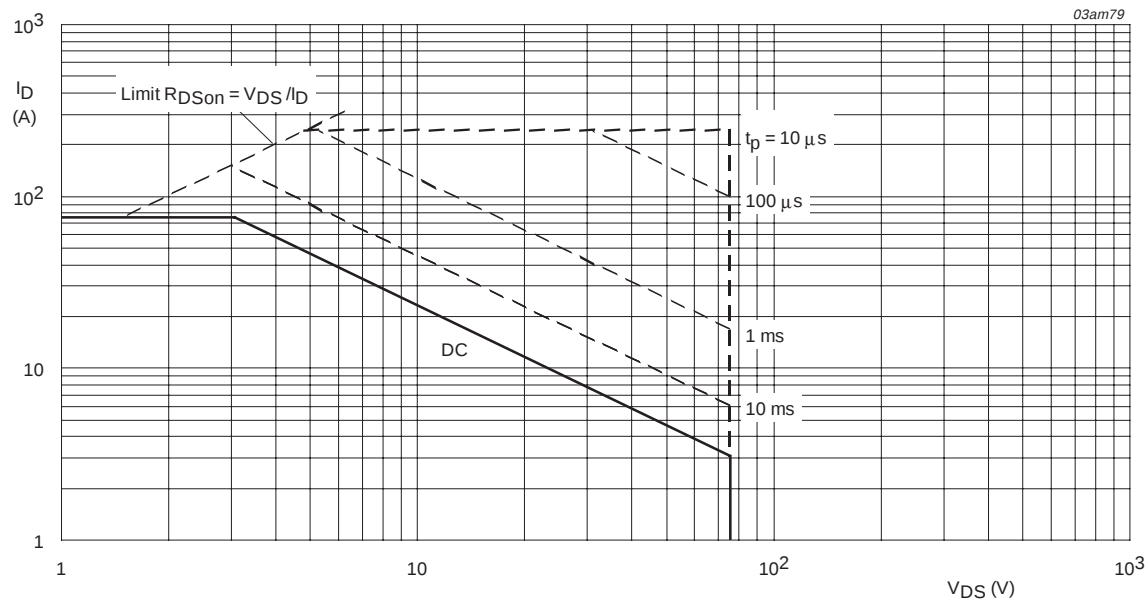
Fig 1. Normalized total power dissipation as a function of mounting base temperature.



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

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

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



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

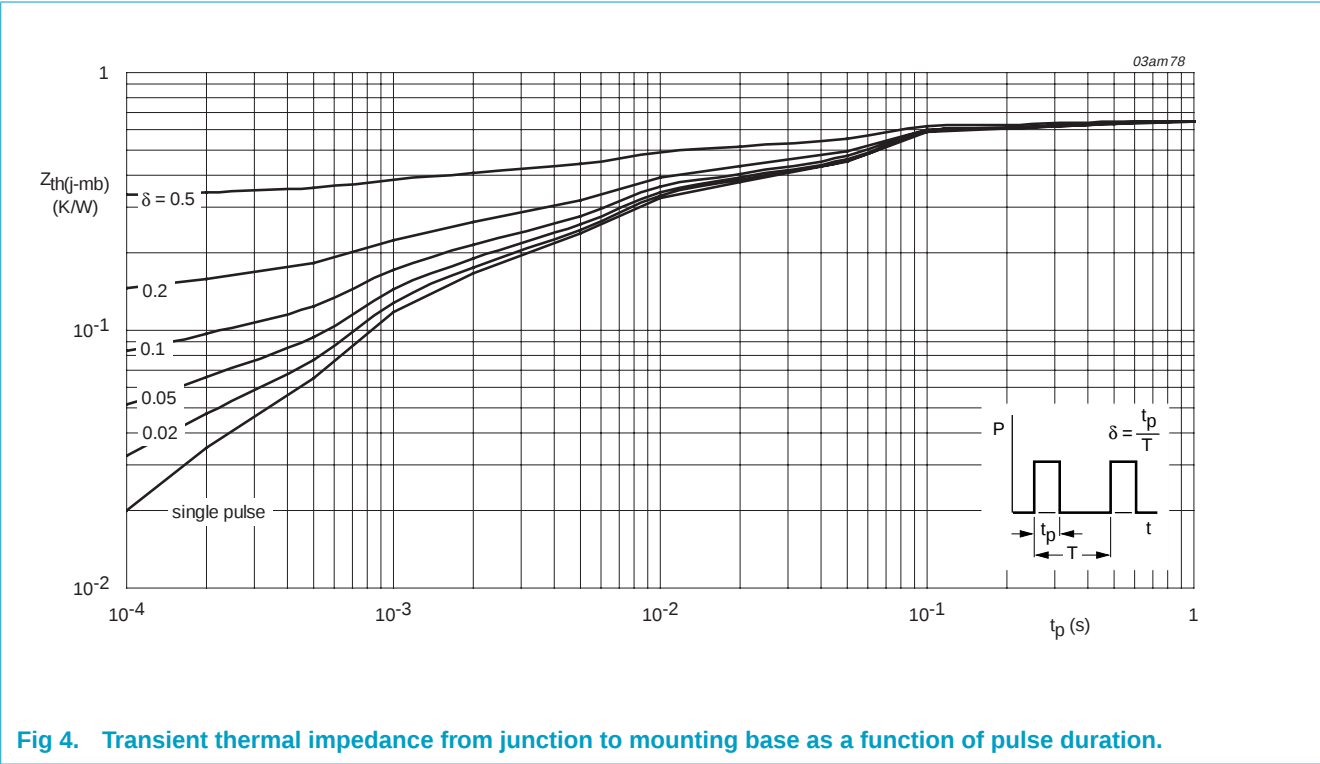
Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage.

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	-	-	0.65	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

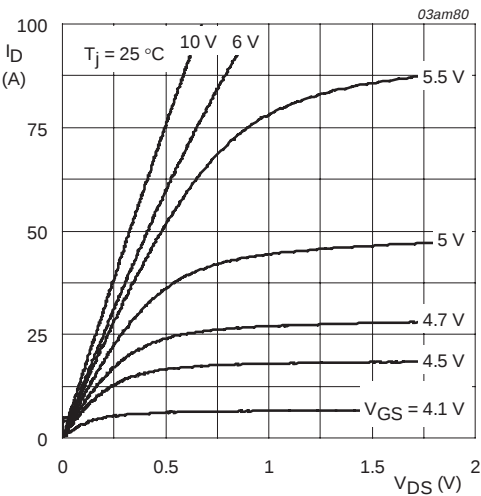
5.1 Transient thermal impedance



6. Characteristics

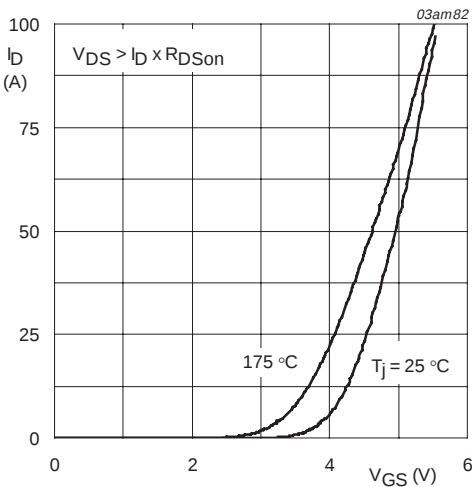
Table 5: Characteristics
 $T_j = 25\text{ °C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
V _{(BR)DSS}	drain-source breakdown voltage	I _D = 250 μA; V _{GS} = 0 V	75	90	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 1 mA; V _{DS} = V _{GS} ; Figure 9				
		T _J = 25 °C	2	3	4	V
		T _J = 175 °C	1	-	-	V
		T _J = −55 °C	-	-	4.4	V
I _{DSS}	drain-source leakage current	V _{GS} = 0 V; V _{DS} = 75 V				
		T _J = 25 °C	-	0.05	10	μA
		T _J = 175 °C	-	-	500	μA
I _{GSS}	gate-source leakage current	V _{DS} = 0 V; V _{GS} = ±20 V	-	4	100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 25 A; Figure 7 and 8				
		T _J = 25 °C	-	6.5	8.5	mΩ
		T _J = 175 °C	-	-	20	mΩ
Dynamic characteristics						
Q _{g(tot)}	total gate charge	I _D = 75 A; V _{DS} = 60 V; V _{GS} = 10 V; Figure 13	-	122.8	-	nC
Q _{gs}	gate-source charge		-	21	-	nC
Q _{gd}	gate-drain (Miller) charge		-	50	-	nC
C _{iss}	input capacitance	V _{GS} = 0 V; V _{DS} = 25 V; f = 1 MHz; Figure 11	-	5260	-	pF
C _{oss}	output capacitance		-	525	-	pF
C _{rss}	reverse transfer capacitance		-	420	-	pF
t _{d(on)}	turn-on delay time	V _{DD} = 37.5 V; R _D = 1.5 Ω; V _{GS} = 10 V; R _G = 10 Ω	-	18	-	ns
t _r	rise time		-	55	-	ns
t _{d(off)}	turn-off delay time		-	88	-	ns
t _f	fall time		-	80	-	ns
Source-drain diode						
V _{SD}	source-drain (diode forward) voltage	I _S = 25 A; V _{GS} = 0 V; Figure 12	-	0.84	1.2	V
t _{rr}	reverse recovery time	I _S = 5 A; dI _S /dt = −100 A/μs;	-	70	-	ns
Q _r	recovered charge	V _{GS} = 0 V; V _R = 30 V	-	100	-	nC



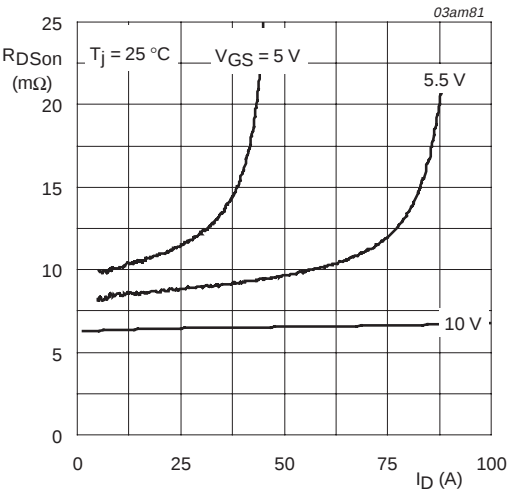
T_j = 25 °C

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



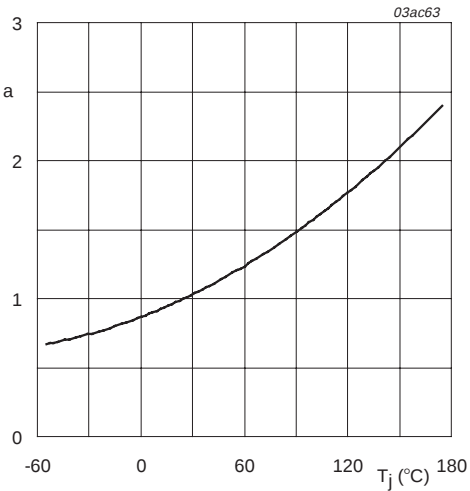
T_j = 25 °C and 175 °C; V_{DS} > I_D × R_{DSon}

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



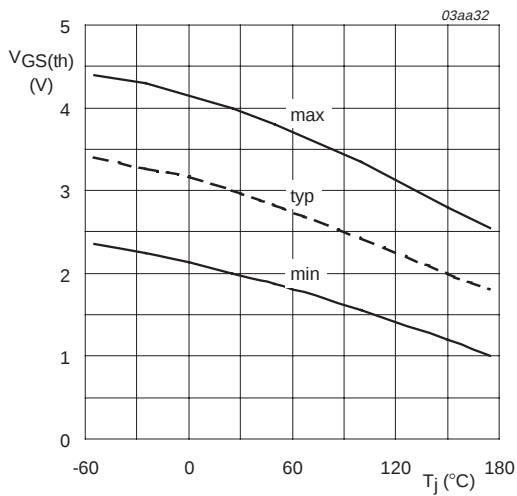
T_j = 25 °C

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



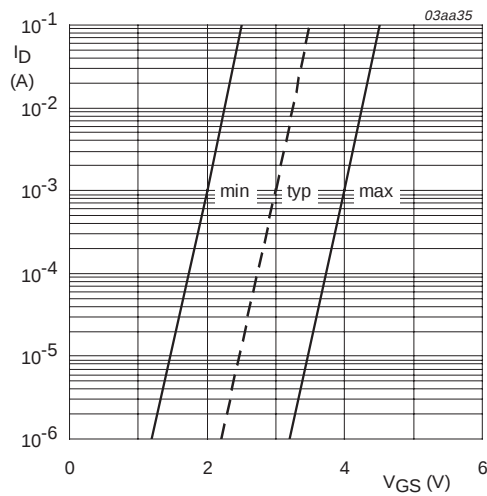
$$a = \frac{R_{DSon}}{R_{DSon(25^{\circ}C)}}$$

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



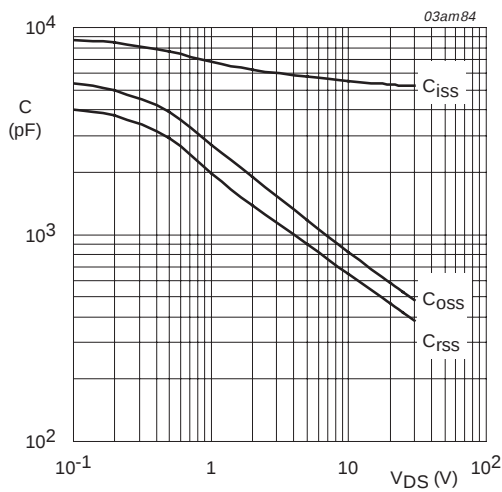
$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$

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



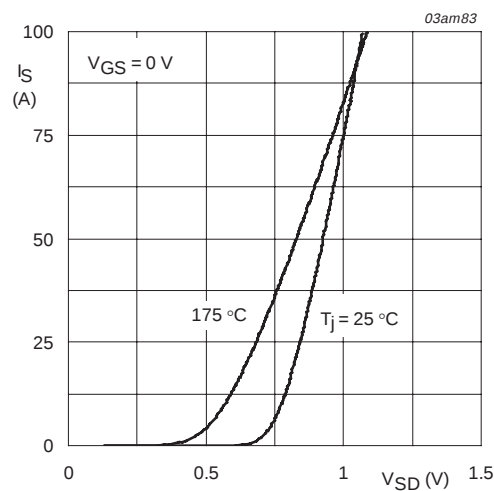
$T_j = 25\text{ °C}$; $V_{DS} = 5\text{ V}$

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



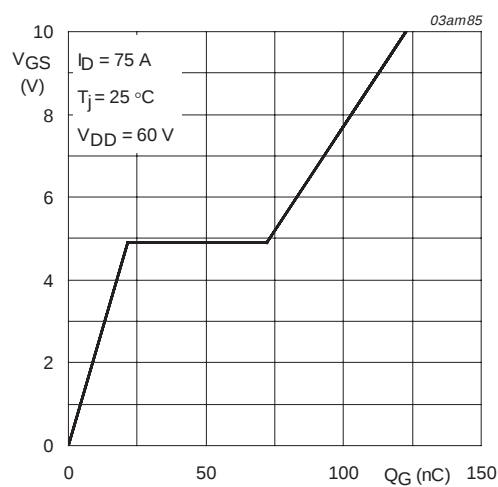
$V_{GS} = 0\text{ V}$; $f = 1\text{ MHz}$

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.



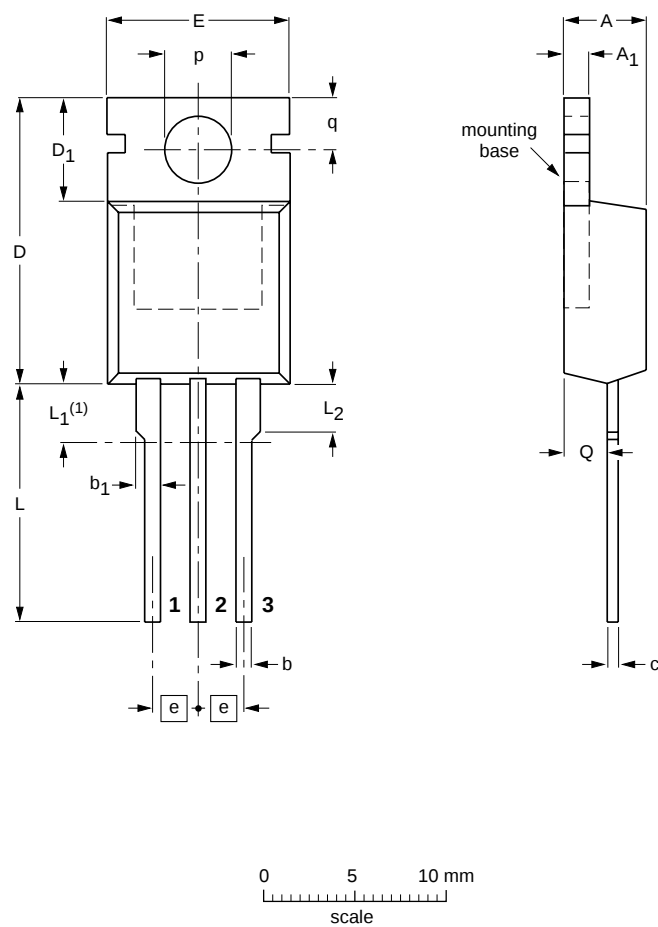
$I_D = 75\text{ A}$; $V_{DD} = 60\text{ V}$

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

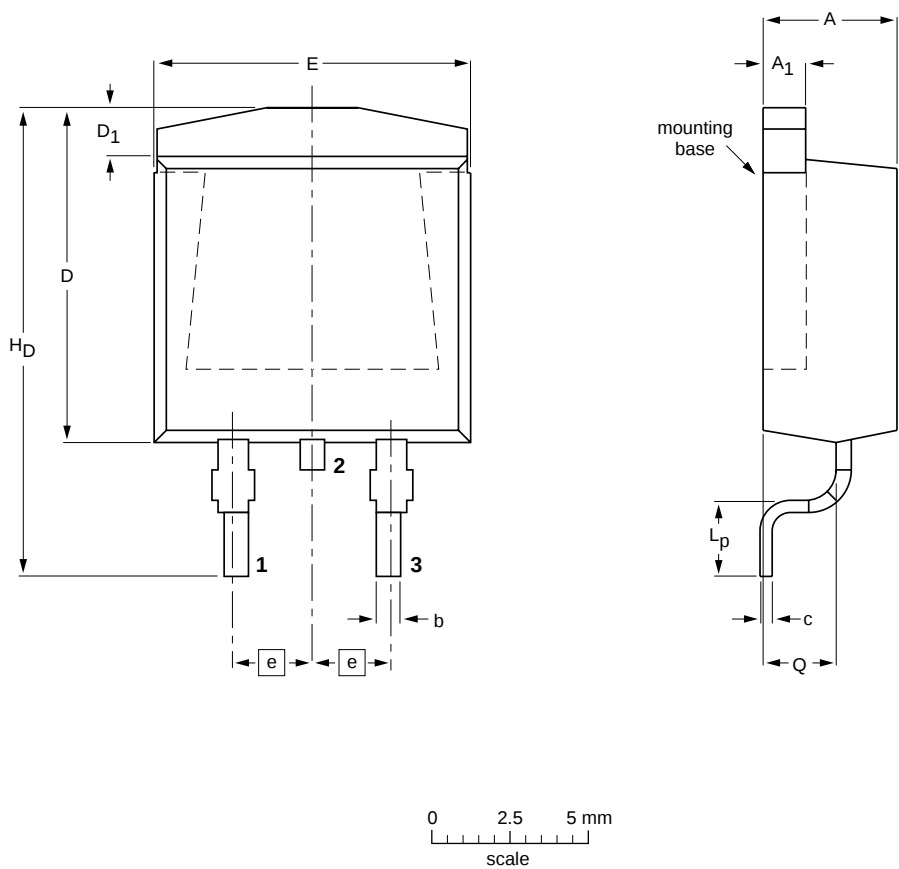
1. Terminals in this zone are not tinned.

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 (TO-220AB).

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
03	20040108	HZG469	Product data (0307 750 12545) Modification: • Updated to latest standards • Section 1.4 “Quick reference data” and Section 6 “Characteristics” typical $R_{DS(on)}$ modified. • Section 4 “Limiting values” EAS changed to $E_{DS(AL)S}$. • Section 4 “Limiting values” Figure 3 modified. • Section 4 “Limiting values” $E_{DS(AL)S}$ conditions and limit modified. • Section 5 “Thermal characteristics” Figure 4 modified. • Section 6 “Characteristics” typical values $Q_{g(tot)}$, C_{iss}, C_{oss}, C_{rss}, t_r, t_{doff}, t_f, t_{rr} and Q_r modified. • Section 6 “Characteristics” Figure 5, 6, 7, 8, 11, 12, 13 modified.
02	20030711		Product data (9397 750 11416) Modifications: • Updated to latest standards. • Section 1.4 “Quick reference data” typical value modified to reflect improved performance. • Section 4 “Limiting values” typographical error T_{amb} changed to T_{mb}. • Section 4 “Limiting values” E_{AS} changed to $E_{DS(AL)S}$. • Section 4 “Limiting values” I_{AS} removed. • Section 4 “Limiting values” Figure 3 modified to reflect device performance. • Section 4 “Limiting values” non-repetitive drain-source avalanche ruggedness current as a function of pulse duration removed. • Section 5 “Thermal characteristics” Figure 4 modified to reflect device performance. • Section 6 “Characteristics” typ values modified to reflect performance. • Section 6 “Characteristics” Figure 5, 6, 7, 11, 12 and 13 modified to reflect device performance. • Section 6 “Characteristics” forward transconductance as a function of drain current; typical values removed.
01	20000918	-	Product data (9397 750 07495).

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.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

10. Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

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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